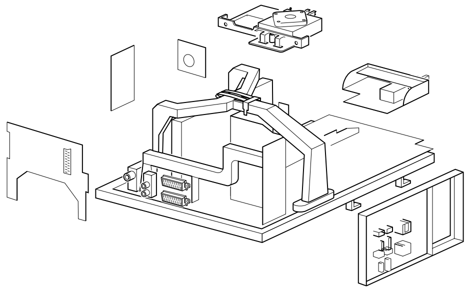
Colour television **Chassis**

# EM3E
## AA

Service
Service
**Service**



CL 16532044_000.eps
150501

# Service Manual

## Contents






Published by CO 0066 Service PaCE    Printed in the Netherlands    Subject to modification    GB 3122 785 11360


PHILIPS

# 1. Technical Specifications, Connection Facilities and Chassis Overview

## 1.1 Technical Specifications

### 1.1.1 Reception

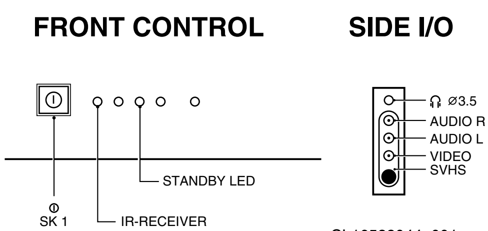
| | | |
|---|---|---|
| Tuning system | : | PLL |
| Colour systems | : | PAL B/G, D/K, I |
| | : | SECAM B/G, D/K, L/L’ |
| | : | NTSC 4.43 (playback only) |
| Sound systems | : | FM-mono B/G |
| | : | FM-mono D/K |
| | : | FM-mono I |
| | : | AM-mono L/L’ |
| | : | 2CS B/G |
| | : | 2CS/Chez D/K |
| | : | NICAM B/G |
| | : | NICAM D/K |
| | : | NICAM I |
| | : | NICAM L |
| A/V connections | : | PAL B/G, D/K, I |
| | : | SECAM B/G, D/K, L/L’ |
| | : | NTSC 4.43 (playback only) |
| Channel selections | : | 100 channels |
| | : | VHF, UHF, S-Channels and Hyperband |
| Aerial input | : | 75 Ω, Coax |
| VCR preselections | : | 0 and 90 - 99 |

### 1.1.2 Miscellaneous

| | | |
|---|---|---|
| Mains voltage | : | 220 - 240 V (± 10 %) |
| Mains frequency | : | 50 / 60 Hz (± 5 %) |
| Ambient temperature | : | + 5 to + 45 deg. C |
| Maximum humidity | : | 90 % R.H. |
| Standby Power consumption | : | 1 W |

## 1.2 Connection Facilities

### 1.2.1 Front Controls / Side Connections




CL16532044_001.eps
260401

**Figure 1-1**

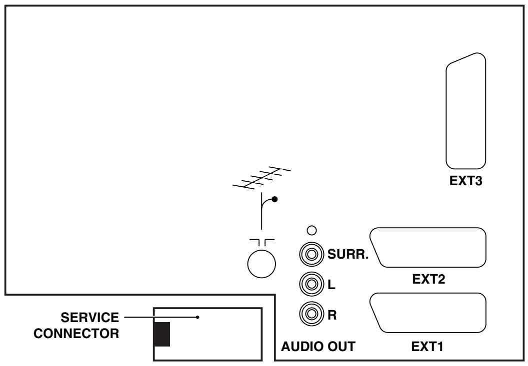
***Audio / Video In***

| | | |
|---|---|---|
| - - Video | CVBS (1 Vpp / 75 Ω) | |
| - - Audio | L (0.5 Vrms / 10 kΩ) | |
| - - Audio | R (0.5 Vrms / 10 kΩ) | |
| - - Headphone | (32 - 2000 Ω / 10 mW) | |

***SVHS (in)***

| | | |
|---|---|---|
| 1 - | GND | |
| 2 - | GND | |
| 3 - Y | (1 Vpp / 75 Ω) | |
| 4 - C / 16:9 | (0.3 Vpp / 75 Ω) | |
| 5 - | GND | |

### 1.2.2 Rear Connections



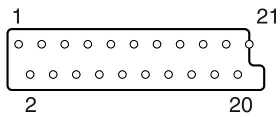

CL16532044_002.eps
090501

**Figure 1-2**

***Audio Out***

| | | |
|---|---|---|
| - - Audio | Surr. (0.5 Vrms / 1 kΩ) | |
| - - Audio | L (0.5 Vrms / 1 kΩ) | |
| - - Audio | R (0.5 Vrms / 1 kΩ) | |

***External 1 (in/out): RGB/YUV + CVBS***




CL96532137_056.eps
171199

**Figure 1-3**

| | | |
|---|---|---|
| 1 - Audio | R (0.5 Vrms / 1 kΩ) | |
| 2 - Audio | R (0.5 Vrms / 10 kΩ) | |
| 3 - Audio | L (0.5 Vrms / 1 kΩ) | |
| 4 - | GND | |
| 5 - | GND | |
| 6 - Audio | L (0.5 Vrms / 10 kΩ) | |
| 7 - Blue / U | (0.7 Vpp / 75 Ω) | |
| 8 - CVBS-status | 0 - 1.3 V: INT<br>4.5 - 7 V: EXT 16:9<br>9.5 - 12 V: EXT 4:3 | |
| 9 - | GND | |
| 10- | | |
| 11- Green / Y | (0.7 Vpp / 75 Ω) | |
| 12- | | |
| 13- | GND | |
| 14- | GND | |
| 15- Red / V | (0.7 Vpp / 75 Ω) | |
| 16- RGB-status | 0 - 0.4 V: INT 1 - 3 V: EXT / 75 Ω | |
| 17- | GND | |
| 18- | GND | |
| 19- CVBS | (1 Vpp / 75 Ω) | |
| 20- CVBS | (1 Vpp / 75 Ω) | |
| 21- Earth | GND | |

***External 2 (in/out): SVHS + CVBS (intended for VCR)***

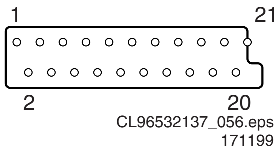



**Figure 1-4**

| Pin | Function | Value |
|---|---|---|
| 1 - Audio | R (0.5 Vrms / 1 kΩ) | |
| 2 - Audio | R (0.5 Vrms / 10 kΩ) | |
| 3 - Audio | L (0.5 Vrms / 1 kΩ) | |
| 4 - | GND | |
| 5 - | GND | |
| 6 - Audio | L (0.5 Vrms / 10 kΩ) | |
| 7 - C | (0.7 Vpp / 75 Ω) | |
| 8 - CVBS-status | 0 - 1.3 V: INT<br>4.5 - 7 V: EXT 16:9<br>9.5 - 12 V: EXT 4:3 | |
| 9 - | GND | |
| 10- | Easy link (P50) | |
| 11- | | |
| 12- | | |
| 13- | GND | |
| 14- | GND | |
| 15- C | (0.7 Vpp / 75 Ω) | |
| 16- | | |
| 17- | GND | |
| 18- | GND | |
| 19- CVBS | (1 Vpp / 75 Ω) | |
| 20- Y / CVBS | (1 Vpp / 75 Ω) | |
| 21- | GND | |

***External 3 (in): CVBS***

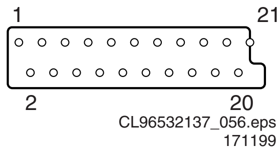



**Figure 1-5**

| Pin | Function | Value |
|---|---|---|
| 1 - | | |
| 2 - Audio | R (0.5 Vrms / 10 kΩ) | |
| 3 - | | |
| 4 - | GND | |
| 5 - | GND | |
| 6 - Audio | L (0.5 Vrms / 10 kΩ) | |
| 7 - | | |
| 8 - CVBS-status | 0 - 1.3 V: INT<br>4.5 - 7 V: EXT 16:9<br>9.5 - 12 V: EXT 4:3 | |
| 9 - | GND | |
| 10- | | |
| 11- | | |
| 12- | | |
| 13- | GND | |
| 14- | GND | |
| 15- | | |
| 16- | | |
| 17- | GND | |
| 18- | GND | |
| 19- | | |
| 20- CVBS | (1 Vpp / 75 Ω) | |
| 21- | | |

## 1.3 Chassis Overview

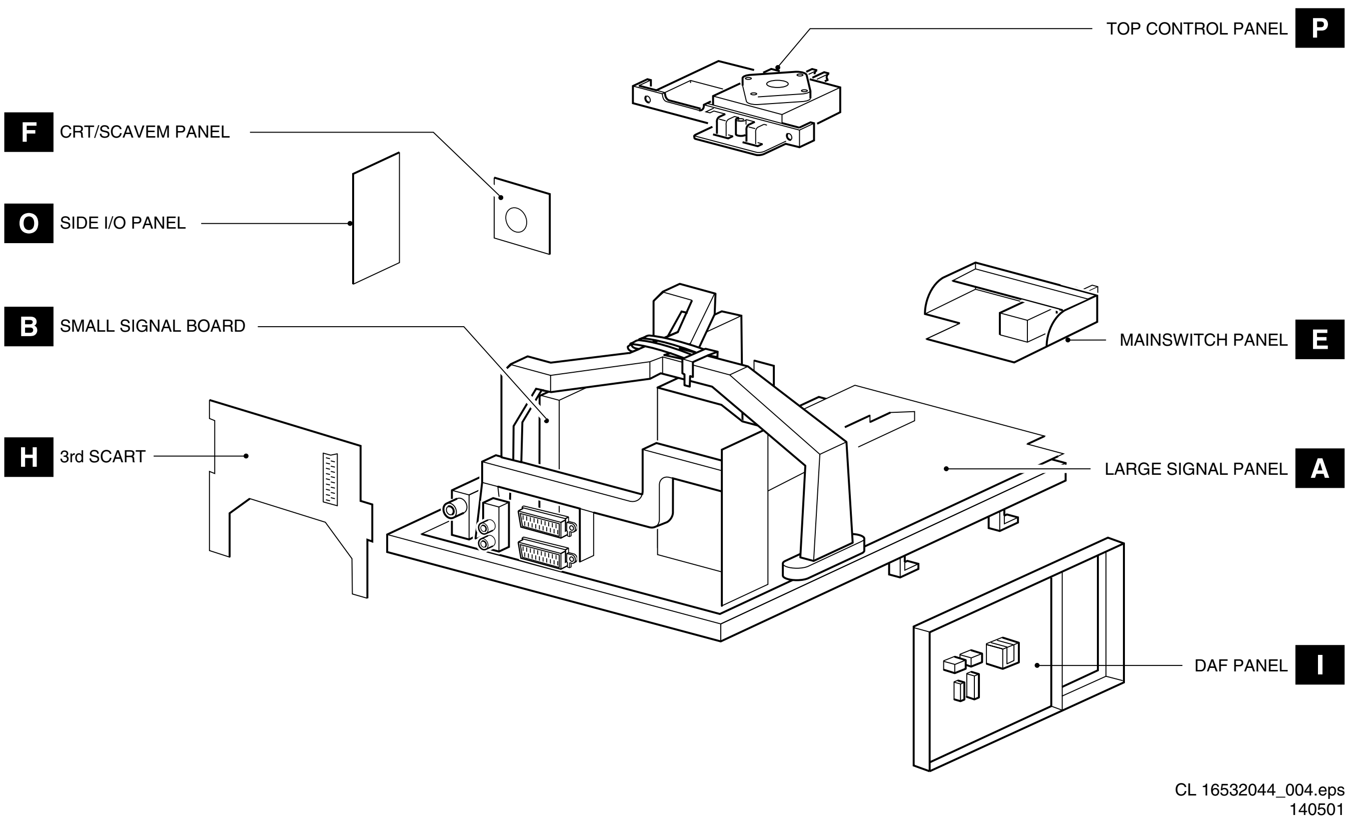



**Figure 1-6**

# 2. Safety & Maintenance instructions, Warnings and Notes

## 2.1 Safety instructions for repairs

Safety regulations require that during a repair:
- Due to the chassis concept, a very large part of this chassis (incl. deflection) is 'hot'. Therefore the set must be connected to the mains via an isolating transformer.
- Safety components, indicated by the symbol ⚠, should be replaced by components identical to the original ones.
- When replacing the CRT, safety goggles must be worn.

Safety regulations require that after a repair, the set must be returned in its original condition. In particular attention should be paid to the following points:
- General repair instruction: as a strict precaution, we advise you to resolder the solder joints, through which the horizontal deflection current is flowing, in particular:
  – All pins of the line output transformer (LOT);
  – Fly-back capacitor(s);
  – S-correction capacitor(s);
  – Line output transistor;
  – Pins of the connector with wires to the deflection coil;
  – Other components through which the deflection current flows.

Note: This resoldering is advised to prevent bad connections due to metal fatigue in solder joints and is therefore only necessary for television sets older than 2 years.
- The wire trees and EHT cable should be routed correctly and fixed with the mounted cable clamps.
- The insulation of the mains lead should be checked for external damage.
- The mains lead strain relief should be checked for its function in order to avoid touching the CRT, hot components or heat sinks.
- The electrical DC resistance between the mains plug and the secondary side should be checked (only for sets which have a mains isolated power supply). This check can be done as follows:
  – Unplug the mains cord and connect a wire between the two pins of the mains plug;
  – Set the mains switch to the 'ON' position (keep the mains cord unplugged!);
  – Measure the resistance value between the pins of the mains plug and the metal shielding of the tuner or the aerial connection on the set. The reading should be between 4.5 MΩ and 12 MΩ.
  – Switch off the TV and remove the wire between the two pins of the mains plug.
- The cabinet should be checked for defects to avoid touching of any inner parts by the customer.

## 2.2 Maintenance instructions

It is recommended to have a maintenance inspection carried out by a qualified service employee. The interval depends on the usage conditions:
- When the set is used under normal circumstances, for example in a living room, the recommended interval is 3 to 5 years.
- When the set is used in circumstances with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is 1 year.
- The maintenance inspection contains the following actions:
  – Execute the above-mentioned 'general repair instruction'.
  – Clean the power supply and deflection circuitry on the chassis.
  – Clean the picture tube panel and the neck of the picture tube.

## 2.3 Warnings

- In order to prevent damage to IC's and transistors, all high-voltage flashovers must be avoided. In order to prevent damage to the picture tube, the method shown in Fig. 2-1 should be used to discharge the picture tube. Use a high-voltage probe and a multimeter (position VDC). Discharge until the meter reading is 0 V (after approx. 30 s).

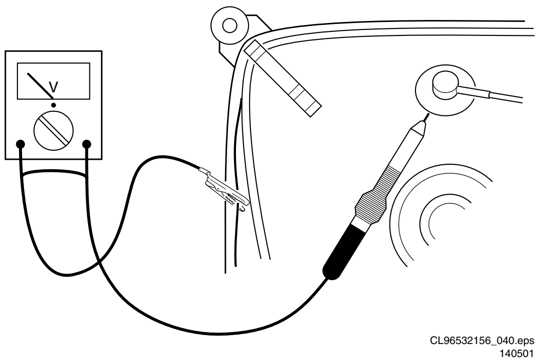



**Figure 2-1**

- All IC's and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this same potential.
- Together with the deflection unit and any multipole unit, the used flat square picture tubes form an integrated unit. The deflection and the multipole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.
- Be careful during measurements in the high-voltage section and on the picture tube.
- Never replace modules or other components while the unit is switched ON.
- When making settings, use plastic rather than metal tools. This will prevent any short circuits and the danger of a circuit becoming unstable.
- Wear safety goggles during replacement of the picture tube.

## 2.4 Notes

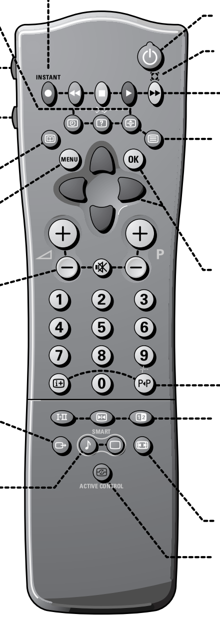
- The direct voltages and oscillograms should be measured with regard to the tuner earth (⏚) or hot earth (⏚).
- The direct voltages and oscillograms shown in the diagrams are indicative and should be measured in the Service Default Mode (see chapter 5) with a colour bar signal and stereo sound (L: 3 kHz, R: 1 kHz unless stated otherwise) and picture carrier at 475.25 MHz.
- Where necessary, the oscillograms and direct voltages are measured with (⊓⊓) and without (⊓⊓) aerial signal. Voltages in the power supply section are measured both for normal operation (⏽) and in Standby (⏻). These values are indicated by means of the appropriate symbols.
- The picture tube PWB has printed spark gaps. Each spark gap is connected between an electrode of the picture tube and the Aquadag coating.
- The semiconductors indicated in the circuit diagram and in the parts lists are completely interchangeable per position with the semiconductors in the unit, irrespective of the type indication on these semiconductors.
- Manufactured under license from Dolby Laboratories Licensing Corporation. DOLBY, the double D symbol and PRO LOGIC are trademarks of Dolby Laboratories Licensing Corporation.

DOLBY SURROUND
PRO • LOGIC

# 3. Directions for use

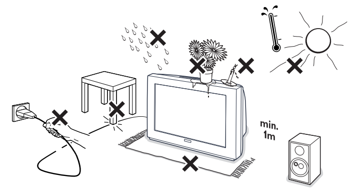
## Preparation

### Your remote control

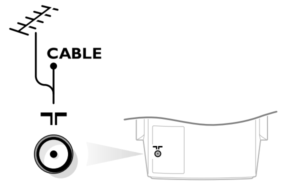



### Preparation

❶ **Place the TV on a solid surface.**

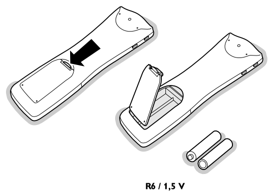



For ventilation, leave at least 5 cm free all around the TV.
Do not place the TV on a carpet.
To prevent any unsafe situations, do not place any objects on top of the TV.
Avoid heat, direct sunlight and exposure to rain or water.




❷ **Insert the aerial plug** firmly into the aerial socket at the back of the TV.

❸ Insert the mains plug in the wall socket having a mains voltage of 220V-240V. To prevent damaging the mains (AC) cord which could cause a fire or electric shock, do not place the TV on the cord.




❹ Remote control: Remove the cover of the battery compartment.
Insert the 2 batteries supplied (Type R6-1.5V).

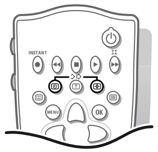
*The batteries supplied do not contain the heavy metals mercury and cadmium. Nevertheless in many countries exhausted batteries may not be disposed of with your household waste. Please check on how to dispose of exhausted batteries according to local regulations.*

*Note: this remote control functions with TVs which use the RC6 signalling standard.*

❺ **Switch the TV on :** Press the power switch on the front of your TV.
A green indicator on the front of the TV lights up and the screen comes on.
If the TV is in standby mode (see p. 9), press the **- P+** key on the remote control.
*The red lamp blinks every time you press a key on the remote control.*
*When you switch on your set **for the first time**, the menu **LANGUAGE** automatically appears on the screen.The explanation appears in different languages one at a time. Choose your own language and press the **OK** key on the remote control.*

Go on to page 4, Store TV channels.

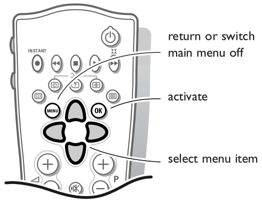
# Installation



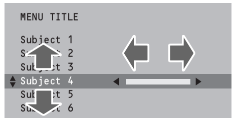
## Select the INSTALLATION menu

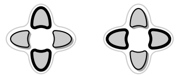
Press [button] and [button] at the same time.

## To use the menus




1. Use the cursor in the up/down, left/right directions to select a menu item.
2. Press the **OK** key to activate.
3. Use the **MENU** key to return or to switch the menu off.



# Store TV channels

*After the new or extra TV channels have been stored, the TV automatically transfers those TV channels to the video recorder if it is equipped with the EasyLink function. The message **EasyLink : downloading ......** appears on the screen. The programme list of the video recorder is now the same as the one of the TV. If the TV is connected to a video recorder which supports the NEXTVIEWLink function, the TV also automatically transfers the language and country selections to the video recorder.*

## Select the menu language and country

```
INSTALLATION
Menu language
```

```
Menu language
English
....
....
```

```
Country
United Kingdom
....
....
```

First, select your language and country.

1. Select **Menu language** and press the **OK** key.
2. Select your language and press the **OK** key.
   Use the cursor up/down to scroll through the list and to bring up other languages which are not displayed on the screen at present.
3. Select **Country** and press the **OK** key.
4. Select the country where you are now located and press the **OK** key.
   Use the cursor up/down to scroll through the list and bring up other countries which are not displayed on the screen at present.

   Select **Other** when none of the countries applies.

   You can now search for and store the TV channels in two different ways: using **automatic installation** or **manual installation** (tuning-in channel by channel).
   Select your choice and press the **OK** key.



```
Automatic installation

Start
Stop              OK

TV is searching
One moment please ...
```

```
Automatic installation

Start             OK
Stop

 1 BBC1
 2 BBC2
 3 CNN
 ....
 ....
```

## Automatic installation

In the Automatic installation menu select **Start** and press the **OK** key to activate the searching. All TV channels are searched for and stored automatically.

If a cable system which broadcasts ACI (Automatic Channel Installation) or a TV channel transmitting a teletext page with the frequencies and programme names of all the TV channels which can be received, is detected, the search is stopped and a programme list appears.
The programme list is automatically filled with all the programme numbers and names of the TV channels transmitted.

*It is possible that the cable company or the TV channel displays a broadcast selection menu. Layout and items are defined by the cable company or the TV channel. Make your choice with the cursor and press the **OK** key.*

To exit from the menu press the **MENU** key on the remote control.

Go on to page 6.

## Manual installation

```
Manual installation

(Selection mode)
 System           OK
Programme no.
Search
Fine tune
Store
```

Searching for and storing TV channels is done channel by channel.
You must go through every step of the Manual installation menu.

**Selection mode** is only present and lights up if the country selected also offers the channel option (C-channels for aerial channels, S-channels for cable channels).
You can choose either channel or frequency mode.

1. Select the TV system
   Select the country or part of the world from where you want to receive the TV channel.
   If you are connected to a cable system, select your country or part of the world where you are now located.
2. Press the cursor down and enter the programme number with the digit keys.
3. Search for a TV channel
   Press the cursor left/right.
   The frequency or the channel number increases until a TV channel is found.

   **Direct selection of a TV channel**
   If you know the frequency, the C- or S-channel number, enter it directly with the digit keys 0 to 9.
   Ask for a list from your cable company or dealer, alternatively consult the Table of frequencies on the inside backcover of this handbook.
4. Fine tune
   In case of poor reception, you can improve the reception by adjusting the frequency with the cursor left/right.
5. To store your TV channel, select **Store** and press the **OK** key.

   Repeat steps 1 to 5 to store another TV channel.
6. To exit from the menu press the **MENU** key on the remote control.

## Give name

```
INSTALLATION

Menu language
Country

Automatic installation
Manual installation
Give name
Reshuffle
Favourite programmes

SETUP
```

It is possible to change the name stored in the memory or to assign a name to a TV channel which has not yet been entered. A name with up to 5 letters or numbers can be given to the programme numbers 0 to 99. For example SUPER, BBC1,... Between 99 and 0 you can also name any peripherals that are connected to a euroconnector.

```
Give name

 EXT1
 EXT2
 EXT3
 FRONT
 0
 1 BBC1
 2 BBC2
 3 ....
 4 ....
 5 ....
```

1. Select **Give name** in the **INSTALLATION** menu and press the **OK** key.
2. Select the programme number.
3. Press the **OK** key.
4. Select the character with the cursor up/down.
5. Select the following position with the cursor right.
6. Select the following character.
7. Press the **OK** key when finished.
8. Press the **MENU** key to return to the **INSTALLATION** menu.

Space, numbers and other special characters are located between Z and A.

## Reshuffle the programme list

```
Reshuffle

 EXT1
 EXT2
 EXT3
 FRONT
 0
 1 CNN
 2 BBC2
 3 ....
 4 ....
 5 ....
```

According to your preference you **can** change the order of the stored TV channels.

1. Select **Reshuffle** in the **INSTALLATION** menu and press the **OK** key.
2. Select the programme number you want to exchange.
3. Press the **OK** key.
4. Select the new number you want to exchange it with.
5. Press the **OK** key.
   Repeat the operation until all TV channels are allocated as you like.
6. Press the **MENU** key to return to the **INSTALLATION** menu.

## Select Favourite TV channels

After leaving the installation you can browse through the TV channels by pressing the **- P +** key. Only those TV channels which are in the favourite list will be displayed. Non-favourite TV channels can still be selected with the digit keys. By default all stored channels are added to the favourite list.

```
Favourite programmes

 0 ...          No
 1 ...          Yes
 2 ...          Yes
 3 ....         No
 4 ....         Yes
 5 ....
```

1. Select **Favourite programmes** in the **INSTALLATION** menu and press the **OK** key.
2. Select your favourite programme number.
3. Select **Yes** or **No** with the cursor left/right.
4. Repeat for every TV channel you want to make a favourite or a non-favourite TV channel.
5. Press the **MENU** key to return to the **INSTALLATION** menu.

*In order for NEXTVIEW to function properly, the first TV channel from the favourite list should also broadcast the correct local date and time via teletext.*



## Install TV Setup

```
INSTALLATION

Menu language
Country

Automatic installation
Manual installation
Give name
Reshuffle
Favourite programmes

SETUP
```

```
SETUP

Digital Sources
Decoder/Descrambler
Picture tilt
Information line
Factory settings
Auto format              yes/no
Auto Surround
INSTALLATION
```

```
Decoder/Descrambler

Programme
Decoder status
```

The Setup menu allows you to adjust initial settings, i.e. those which are not related to the installation of the TV channels.
The Setup menu contains items that control the settings of the TV's functions, features, services and peripherals you may have connected.

1. Use the cursor in the up/down, left/right directions to select the menu item.
2. Use the **OK** key to activate.
3. Use the **MENU** key to return or switch menu off.

**Digital sources** *(for future use)*

**Define Decoder/Descrambler programme numbers**
If a decoder or a descrambler is connected, see p. 22 you can define one or more programme numbers as decoder programme numbers.

Press the cursor left/right to select the input used to connect to your decoder **Off**, **EXT1** or **EXT2**.
Select **Off** if you do not want the selected programme number being activated as a decoder programme number.

easy LINK

*Select **EXT2** when the decoder is connected to your EasyLink video recorder. When selecting the decoder, the message **EasyLink: downloading presets....** appears on the screen.*

**Picture tilt**
Select **Picture tilt** with the cursor up/down.
Keep the cursor left/right pressed to adjust the rotation of the picture.

**Information line**
Select **On** and after the selection of a TV programme or after pressing the [i+] key on the remote control, a TV channel which broadcasts teletext may transmit the name of the TV channel, the programme name or another message. This is displayed on screen next to information about sound and picture format.
When selected **Off**, only sound and picture format information is displayed after the selection of a TV channel or after pressing the [i+] key.

**Factory settings**
Select **Factory settings** and press the **OK** key to restore picture and sound settings, predefined in the factory.

**Auto format**
Selecting **Yes** causes the screen to automatically fill as much of the picture as possible when TV programmes are not carrying special signals detecting the correct screen format.
With the [format] key on the remote control you can still select other picture formats. See p. 10.

```
SETUP

Digital Sources
Decoder/Descrambler
Picture tilt
Information line
Factory settings
Auto format                  yes/no
Auto Surround
INSTALLATION
```

**Auto Surround**
Sometimes the broadcaster transmits special signals for Surround Sound encoded programmes. In that case, the TV automatically switches to the best Surround Sound mode when Auto Surround is switched on. Virtual Dolby* Surround will be reproduced, see p. 9.
Overruling this surround mode remains possible.

**Installation**
Select **Installation** and press the **OK** key to return immediately to the **INSTALLATION** menu.

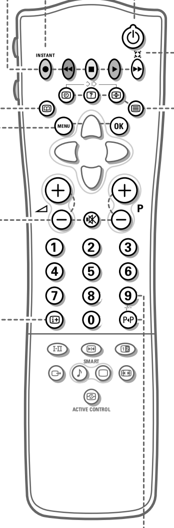
4 To exit from the menu press the **MENU** key repeatedly.

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# Operation

## Use of the remote control




**● Instant record**
If your video recorder has the EasyLink function the **INSTANT** ● key for record can be operated in the TV mode.

**● ◀◀ ■ ▶ ▶▶ Video recorder** see p. 24

**NEXTVIEW/TXT guide** on/off see p. 15

**MENU Main menu** on/off see p. 11

**OK** Press this key to activate your choice, when in the menus.

**Volume**
Press + or - to adjust the volume.

**Mute**
Temporarily interrupt the sound or restore it.

**P Programme selection**
To browse through the TV channels activated in the Favourite Programme menu.

**Screen information**
Press for 5 seconds to activate/de-activate the extended or reduced display of TV channel and programme information on the screen.
Press briefly to display information about the selected TV channel and programme, the sound reception, picture settings and the remaining time set with the sleeptimer.

**0/9 Digit keys**
To select a TV channel.
For a two digit programme number, enter the second digit within 2 seconds.
To switch immediately to a selected one digit TV channel, keep the digit key pressed a bit longer.

**P◂P Previous programme**
The previously selected TV channel is displayed.
The -/-- indication is only video recorder.

**Standby**
The set is switched off. To switch the TV on again, press **- P +** or the digit keys.
If your EasyLink video recorder has the system standby function and you press the standby key for 3 seconds, both the TV and video recorder are switched to standby.
*Your TV consumes energy in the standby mode. Energy consumption contributes to air and water pollution. We advise to switch off your TV overnight instead of leaving it on standby. You save energy.*

**Surround modes**
**Incredible Surround**
With stereo transmission, and when **Incredible Surround** is selected, it seems as though the loudspeakers are spread further apart from one another.

**Virtual Dolby Surround**
*(optimal with Dolby Surround signals)*
Virtual Dolby Surround enables you to experience the effect of Dolby Surround Pro Logic, reproducing a rear sound effect.
See Sound menu, Virtual Dolby effect, p. 12.

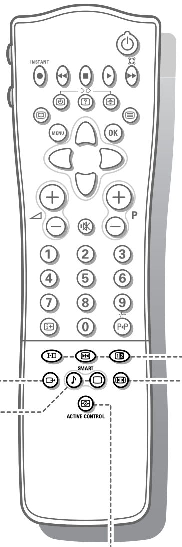
**Teletext** on/off see p. 19

**Teletext functions** see p. 20

**Zoom**
Press the **ZOOM** key repeatedly to select one of the zoom magnifications (x1, x4, x9, x16). Additionally you can shift the selected zoom window over the screen with the cursor.
Press to activate/de-activate the continuous display of the zoom magnification.
The zoom window is reset after: selecting another TV channel, another picture format or when another picture format is selected automatically.
*Zooming is disabled in Dual screen mode.*

**Time display**
The time, downloaded from the TV channel (with teletext) stored on programme number 1 or the lowest favourite programme number, is displayed on the screen.
*This function is not available when continuous subtitles have been switched on.*

## Use of the remote control



**Select peripherals**
Press this key repeatedly to select **EXT1**, **EXT2**, **EXT3** or **FRONT**, according to where you connected the peripherals (p. 24).

**Smart Keys**
To select predefined picture and sound settings.

**Smart Sound**
Each time it is pressed, a different sound setting is selected, corresponding with specific factory settings of the equalizer.

**Smart Picture**
Each time it is pressed, a different picture setting is selected, corresponding with specific factory settings of Contrast, Colour, Sharpness and Dynamic Contrast.

**Personal** refers to the personal preference settings of picture and sound selected in the picture and sound menu.
*Remark: the moment you are in a predefined smart sound or picture setting and you modify a setting in the picture or sound menu, all values of the menu will overwrite the previously made settings.*

**I-II Bilingual choice and sound mode selection**
Press this key
- to switch from **Stereo** to **Mono** sound, in case of stereo transmission, or from **Nicam Stereo** to **Nicam available**, in case of digital transmission;
- to choose between language I (Dual I) or language II (Dual II), in case of bilingual transmission. The setting is separately stored for each TV channel.

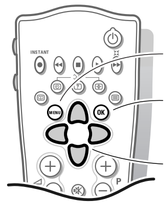
**Freeze**
To activate/de-activate the frozen picture or to hold a teletext page.

**12** Dual screen, see p. 14

**Picture format**
Press this key repeatedly to select another picture format: 4:3, Movie Expand 14:9, Movie Expand 16:9 with or without subtitling, Wide Screen, Super Zoom or Automatic (when Auto format is set to Yes in the **SETUP** menu).
Automatic makes the picture to fill the screen as much as possible.
Sometimes also video recorder programmes carry special signals which will automatically switch the TV to the correct screen format.
*Auto format is disabled when in Dual screen.*
When in Movie Expand 14:9 or 16:9 or Super Zoom picture format you can make subtitles visible with the cursor up/down.

**Active control**
Active control is a pro-active and automatic system. The TV continuously measures and corrects all incoming signals in order to provide the best picture possible.
Press the key to select the Active Control values Off or On.
**Off** Sharpness and Dynamic Contrast are controlled automatically
**On** Sharpness, Dynamic Contrast and Noise Reduction are controlled automatically.
Press the cursor in the up/down directions while the selected Active Control setting information is on top of the screen.
The Active Control menu appears.
The picture settings are being adapted continuously and automatically.
The menu items cannot be selected.
Press the cursor in the up/down directions again to switch off the menu.

## Use of the menus




```
MAIN MENU
PICTURE
SOUND
FEATURES
PROGRAMMES
```

```
PICTURE
Contrast
Brightness
Colour
Sharpness
Tint
Digital options
Dynamic Contrast
```

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **PICTURE**, **SOUND** or **FEATURES** menu or to select the **PROGRAMMES**.
3. Press the cursor right to activate the selected menu.
4. Use the cursor in the up/down, left/right directions to select the menu item.
5. Use the **OK** key to activate.
6. Press the **MENU** key repeatedly to return or to switch the menu off.

### Picture menu

*If an NTSC peripheral is connected to one of the euroconnectors, the option Hue also appears.*

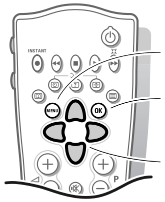
**Tint**
Select the colour temperature: **Normal**, **Warm** or **Cool**.

**Digital options**
Although Natural Motion is the most ideal setting, it may be preferable to switch back to Digital Scan and/or 100 Hz.
To make all the 3 digital options available at the same time and selectable, first select a 4:3 picture format.
- **100 Hz** = 100 Hz only (Field flicker reduction)
- **Dig. Scan** = 100 Hz + Dig. Scan (Field and line flicker reduction)
- **Natural Motion** = 100 Hz + Dig. Scan + Natural Motion (Field and line flicker reduction and smooth movement reproduction)
- **Double lines** = provides for a doubling of vertical resolution which adds astonishing sharpness and a total absence of visible picture lines.
  Motion compensation reduces jitter and offers smooth, yet sharp motion reproduction.

*Note: if the menu item Digital options is not present, first select a 4:3 picture format with the key.*

**Dynamic Contrast**
To make the contrast in the darker and the brighter picture areas more noticeable, select the **Med** setting.
In certain circumstances it may be preferred to select **Min, Max** or **Off**.

The modified adjustments for Contrast, Brightness, Colour, Sharpness, Tint, Digital Scan and Dynamic Contrast are automatically stored for all TV channels.
Select **Factory settings** in the Setup menu to restore the predefined factory settings, see p. 7.




```
SOUND
Volume
Balance
Graphic Equalizer
Headphone Volume
AVL
Delta volume
Virtual Dolby effect
```

## Sound menu

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **SOUND** menu.
3. Use the cursor in the up/down, left/right directions to select the menu item.
4. Use the **OK** key to activate.
5. Press the **MENU** key repeatedly to return or to switch the menu off.

The modified adjustments for Volume, Balance, and Graphic equalizer are automatically stored for all TV channels.
Select **Factory settings** in the Setup menu to restore the predefined factory settings, see p. 7.

**Graphic Equalizer**
Here you can select the preferred sound setting which corresponds with the personal sound settings.

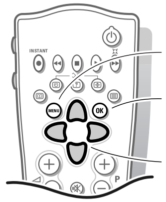
**Headphone volume**
See Connect Peripheral Equipment, p. 23, for the connection of the headphone.

**AVL (Automatic Volume Leveller)**
AVL automatically controls the volume level to avoid too large level differences, especially when switching to another programme or during commercial breaks.
AVL will reduce the dynamics of the sound. To maintain original dynamics, use the Delta volume feature.

**Delta volume**
Here you may adjust the volume differences of each selected TV channel or external device separately. This can compensate volume differences between different broadcasters.
Use the **- P +** keys to compare to the volume of other TV channels or externals.

**Virtual Dolby effect**
Virtual Dolby enables you to experience the effect of Dolby Surround Pro Logic without the need of having rear speakers connected or activated.
Select the level of **Virtual Dolby effect** with the cursor left/right.






```
FEATURES
Sleeptimer     Off
Child lock     Off
Subtitle       Off
```

## Features menu

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **FEATURES** menu.
3. Use the cursor in the up/down, left/right directions to select the menu item.
4. Use the **OK** key to activate.
5. Press the **MENU** key repeatedly to return or to switch the menu off.

**Sleeptimer**
With the sleeptimer you can set a time period after which the TV should switch itself to standby.
The counter runs from **Off** up to **180 min.**
One minute before the TV is set to go to standby, the remaining seconds appear on screen. Not visible in dual screen mode. You can always switch off your set earlier or change the set time.

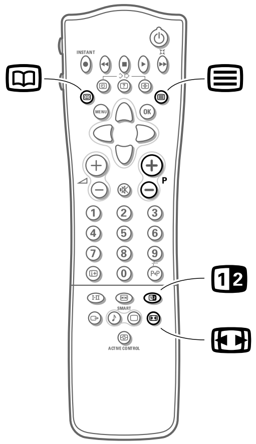
**Child lock**
If the child lock is on, the TV can only be switched on with the remote control. The **P** - and + keys on top of the TV cannot be used to select a TV channel. In this way you can prevent unauthorised use of your TV.
If the message **Child lock On** appears, the child lock must be switched off before you can use the **P** - and + keys on top of the TV to select a TV channel.

**Subtitle**
TV channels with teletext often transmit certain programmes with subtitling. See Teletext, Continuous Subtitles, p. 21 how to select the proper subtitle page from the teletext index.
Select **Subtitle On** or **Off**.

Press the **MENU** key to switch off the Features menu.

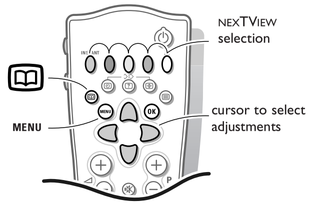
## Programme list

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Select **PROGRAMMES** with the cursor up/down.
3. Press the cursor right to display an overview of all the TV channels installed.
4. Press the cursor up/down to run through the list and press **OK** to select the desired TV channel.
5. Press the **MENU** key to switch off the Programme list.




## Dual Screen

1. Press the [12] key to switch on Dual Screen.
   The TV screen is divided into 2 parts:
   - the left side for the normal main picture,
   - the right side for teletext broadcast by the selected TV channel or for NEXTVIEW/Teletext Guide.
   To operate NEXTVIEW/Teletext Guide, see p. 15.
   To operate teletext, see p. 19.
   *If Dual Screen is Off, the picture, teletext or NEXTVIEW/Teletext Guide are displayed full screen.*
2. Press the [⬌] key to select a vertical squeezed or a non vertical squeezed picture size
3. Press **+ P -** to run through the teletext pages.
4. When in Teletext Dual Screen, press the [≣] key to return to a full picture screen or press the [12] key to return to a full Teletext screen.
5. When in NEXTVIEW/Teletext Guide Dual Screen, press the [📖] key to return to a full picture screen or press the [12] key to return to a full NEXTVIEW/Teletext Guide screen.




## NEXTVIEW / Teletext Guide

Today, most broadcasters in Europe, are offering teletext pages containing their programme schedule of today. These pages can be requested by switching the TV to **Teletext Guide**.
An increasing number of broadcasters are offering an extended programme guide service called **NEXTVIEW.** NEXTVIEW is a new way of presenting programme schedules and offers more features than common teletext.
With NEXTVIEW it is possible to show for instance all the movies coming tonight.

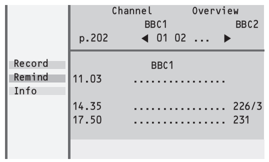
Both facilities are integrated in this TV: NEXTVIEW and Teletext Programme Guide. If a TV channel supports NEXTVIEW then the TV will automatically present the NEXTVIEW programme schedule. If the TV channel supports just teletext, then the TV will switch automatically to Teletext Guide.
Both facilities are offering the same functions: record, remind and info.
However in case of Teletext Guide the broadcaster is responsible if these functions are possible.
You can search for the programmes you want to watch up to 7 days in advance.
It is also possible to search for a programme by theme, e.g. sport, movie, etc.
Once a programme has been selected it can be tagged, to remind you, or to record on the video recorder automatically (provided the video recorder is equipped with NEXTVIEWLink Level 2.0), once, daily, weekly or series.
Teletext Guide/NEXTVIEW also allows direct access to detailed information about programmes if provided by the broadcaster.

*The broadcaster is responsible for the contents of the information.*
*The TV is responsible for the capture of that information and for the presentation to the user.*

### Use of the Teletext Guide/NEXTVIEW menus

1. Press the [📖] key on the remote control to display/cancel the Teletext Guide/ NEXTVIEW menu.
2. Use the cursor in the up/down, left/right directions to select the date, **CHANNEL** for the channel guide, **THEME** for the theme guide, **OVERVIEW** for an overview of all the programmes which are marked as reminders or for recording, the programme guide page number or to enter the programme list.

**Teletext Guide**

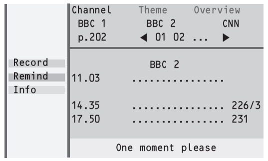



3. Enter the proper programme guide page number with the digit keys or with the **– P +** keys.
4. Press the cursor left/right to run through the subpages.
5. Select a programme with the cursor up/down.
6. Press one of the colour keys to select one of the basic functions (if available); **record**, **remind**, **info**. See Basic functions further on.
7. Press the **OK** key to return to the header area again.

**NEXTVIEW**




3. Select a programme with the cursor up/down.
4. Press one of the colour keys to select one of the basic functions (if available); **record**, **remind**, **info**. See Basic functions further on.
5. Press the **OK** key to return to the header area again.




## Teletext guide

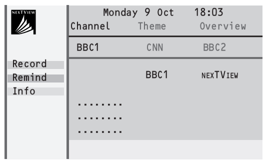
TV channels which broadcast teletext also transmit a page with the programme guide of the day. For each selected TV channel the programme guide page can be selected with the [teletext] key:

- automatically if the selected TV channel supports services like PDC (Programme Delivery Control) or MIP (Magazine Inventory Page).
- if automatic pre-selection is not possible then the index page is displayed and the proper programme guide page number of the selected TV channel has to be entered with the digit keys.

The programme guide page will be stored automatically only if it satisfies Video Programming via Teletext (VPT) requirements.

Every time you press the [teletext] key, the programme guide page of the selected TV channel will be available if the TV channel does not support NEXTVIEW.

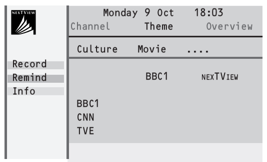
The function items record, remind and info, corresponding with the coloured keys, become highlighted if the displayed programme page satisfies the Video Programming via Teletext (VPT) requirements. Select a programme item and press one of the function keys, e.g. Record or Remind. See Basic functions further on.
The Info item is enabled if the selected programme contains a page number with an optional subcode referring to a page with more info about the programme.




## NEXTVIEW modes to sort and represent information

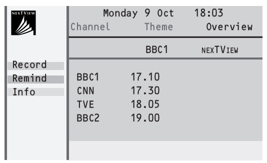
### Channel

The Channel guide provides an overview of all programmes that are broadcast by a single channel during one day.
Already passed programmes can be made visible via cursor up.
The list will start with the earliest broadcast programme.
With cursor left/right another favourite TV channel can be selected.




### Theme

The theme guide displays a list of all programmes at the selected date, that matches with the selected category (news, sport, culture, movies, …).
The default starting item will be the current or next programme on the current TV channel.
The **THEME** selection is only present if programmes in the TV guide have defined themes.



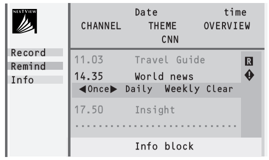

### Overview

The Overview menu provides a list of programmes that are marked as reminders or to be recorded each day.
When more than one programme to be recorded has an overlap in time, these programmes will be marked by a red colour.

After the programme has been broadcast, all items set for once will be deleted from the list the following day. This menu can be used to change a reminder or recorder.

*Note: the TV will automatically interpret the broadcast time (as shown on the teletext guide) of your selected programme into the correct local time and date.*






## Basic functions

The functions Record, Remind and Info can be activated with the corresponding colour keys on the remote control.
If the function is not available, then the text is shown at reduced brightness.
Select a programme with the cursor up/down.

### Record [R] or Remind [!]

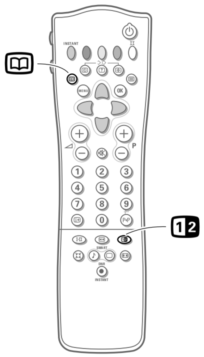
1. Press the red colour key to activate **Record** or the green colour key to activate **Remind.**
   *If the programme number of the broadcaster is not yet known, a message appears with the request to input the correct programme number with the cursor left/right and press OK.*
   A small menu pops up in which you can choose the interval: once, daily or weekly, or clear an earlier made record or remind setting. The default interval is set to **Once**. If a programme is an episode of a series, it is identified by the system and the options **daily** and **weekly** are replaced by the option **series**. In this case the system identifies when the next episode of the series will be broadcast. This is not possible in the Teletext guide.
2. Use the cursor in the left/right directions to select the interval.
   The colour of the tag refers to the interval.
3. Press the **OK** key.

When **Record** [R] is activated:
**Storing** is displayed to indicate the video recorder is programmed.
When **Remind** [!] is activated:
- a message will be displayed the moment the tagged programme with [!] starts, when watching the TV later on.
- the TV switches on the moment the tagged programme with [!] starts, when the TV is in standby.

*Note: Recordings and reminders are not possible when the broadcaster does not transmit dates and times of the programmes.*
*The message **No TV programming possible** appears.*
*Make sure you are on the TV programming page.*

### Info

1. Press the yellow colour key to activate **Info**.
   Advertisements or information relating to the selected programme are displayed. In some cases all of the information does not fit on the screen. Use the cursor up/down to browse through all the information.
2. Press the yellow colour key again to switch off the information.



## Select Picture/NEXTVIEW-Teletext Guide

Press the key.
Press the key.
The screen is divided into two parts: the left side for the normal main picture, the right side for NEXTVIEW/Teletext Guide.
Press the key to return to a full NEXTVIEW/Teletext guide screen, or press the key to return to a full picture screen.

## Acquisition and updating of NEXTVIEW information

Acquisition and updating of NEXTVIEW is done when you are watching a TV channel supporting NEXTVIEW.

## Video recorder restrictions with NEXTVIEW

The **Record** item and the automatic recording will only be present and possible if your video recorder is equipped with NEXTVIEWLink.
Your video recorder should be connected to **EXTERNAL 2**. See Connect Peripheral Equipment, p. 22.

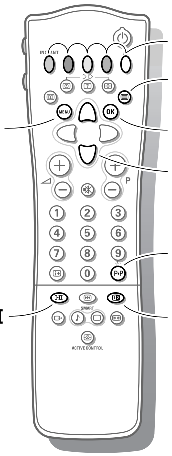
The daily, weekly and series options, the number of recordings set and the way overlapping recordings are managed, depend on the type of video recorder you have. When all video recorder timers are full, the item **Record** in the menu will not be present.

Upload video recorder overview
When the TV is switched on, the timer recordings are uploaded to the TV to check if any manual addition or deletions have been done. This is shown in the overview.
The video recorder manages and removes timer recordings when performed.

Some NEXTVIEWLink video recorders do not allow a daily programming of the recording to start on a Saturday or Sunday. In this case the item **daily** will be removed from the menu on those days.








Most TV channels broadcast information via teletext.
Each channel which broadcasts teletext transmits a page with information on how to use its teletext system. Look for the teletext page with the main index (usually p. 100).
Depending on the TV channel, teletext is transmitted in different systems.
The colours used in the options line correspond with the colour keys of your remote control.

## About Easy Text

Easy Text considerably reduces the waiting time (on condition that the teletext broadcast of the particular TV channel is received for at least half a minute) by :

- a direct selection of previous and following pages which are in transmission and of the pages referred to in the options line
- a habit watcher list: frequently used pages are put automatically in a list of preferred pages, so that they are immediately available
- the precapturing of the page numbers referred to in the displayed page
- the precapturing of all the subpages.

## Switch Teletext on and off

Press to switch the teletext on or off.
The main index page appears on the screen together with two information lines at the top and one option line at the bottom of the screen.

*Remark: if the displayed teletext characters on screen do not correspond with the characters used in your language, press the I-II key repeatedly to select Language group 1 or 2.*

## Select a Teletext page

**With the digit keys**
Enter the desired page number with the digit keys.
The page counter seeks the page or the page appears immediately when the page number has been stored in the memory.
*A message appears when you have entered a non existent or incorrect page number. Page numbers beginning with 0 or 9 do not exist. Choose another number.*

**With the option line**
Select with the colour keys, corresponding to the coloured options at the bottom of the screen, the desired subject.

## Select Picture/Teletext

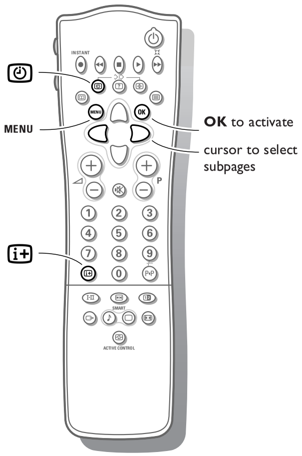
Select a TV channel which broadcasts teletext.
Press the key.
The screen is divided into two parts:
the left side for the normal main picture,
the right side for teletext broadcast by the selected TV channel.
Press the key to return to a full screen picture or press the key to return to a full teletext picture.

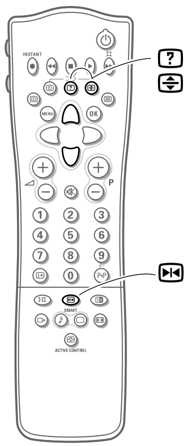
## Quickly run through the teletext pages

Press the cursor up/down or the **- P +** key to run through the previous or the following pages.

## Select the previously selected teletext page

Press the P◂P key.



## Select the index teletext page

Press the white colour key to display the main index (usually p.100).

**Only for T.O.P teletext broadcasts :**
T.O.P orders the pages in categories and adds other possibilities of enhancing ease of use.
Press [i+]. A T.O.P. overview of the teletext subjects available is displayed.
Not all TV channels broadcast T.O.P. teletext. When the teletext system is not T.O.P. teletext, a message appears at the top of the screen.
Select with the cursor up/down, left/right the desired subject and press the **OK** key.

## Select subpages

When a selected teletext page consists of different subpages, one of the subpages appears on the screen.
The coloured number in the first information line refers to the displayed subpage.
The other subpages can be selected in 2 ways :

**With the cursor left/right**
The other subpage numbers appear in white as soon as the transmission has found them. They are stored in the memory so that they are available while the teletext page is on screen.
Select with the cursor left/right the previous or the following subpage.

**With the ⊚ key**
• Enter the subpage number yourself:
Press ⊚. Enter the desired subpage with the digit keys : e.g. 3 for the third page of seven subpages.
The TV searches for the selected subpage.

• Automatically rotating subpages:
Press ⊚ again to cancel the entered digit key for the subpage.
Now the subpages rotate automatically.

Press ⊚ again to select the subpages with the cursor left/right again.

## Special teletext functions

**Hold**
Press ⧓ to stop the automatically rotating of the subpages or to stop the page counter from seeking when you have entered a wrong page number or when the page is not available.
Enter another page number.

**Enlarge**
Press ⇕ repeatedly to display the upper part, the lower part and then to return to the normal page size. When the upper part is displayed, you can scroll the text, line by line using the cursor up/down.

**Reveal**
Press [?] to reveal/conceal the hidden information, such as solutions to riddles and puzzles.



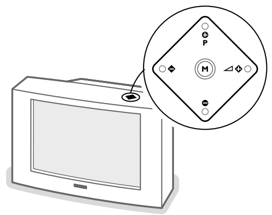
## Select Continuous Subtitles

TV channels with teletext often transmit programmes with subtitling. For each TV channel you can store a subtitle page which will be displayed continuously if the programme being broadcast is transmitted with subtitles.

Switch on teletext and select the proper subtitle page from the index.
Switch off teletext.
Now the subtitle page is stored for the selected TV channel.

Once subtitles have been stored and **Subtitle On** has been selected they will automatically be displayed on the selected TV channel if subtitles are in the transmission.
Select **Subtitle On** or **Off** in the Features menu, see p. 13.
The subtitle symbol ⊟ appears when **Subtitle On** is selected.

*Remark: you are in teletext mode, so only teletext functions are available.*




## Keys on top of the TV

Should your remote control be lost or broken you can still change some of the basic picture settings with the keys on top of the TV.

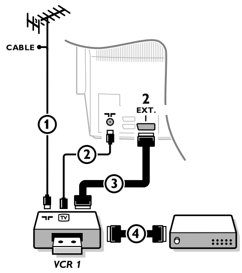
Press the **M** key repeatedly to select **Volume**, **Brightness**, **Colour**, **Contrast**.
Press the **P** - or + keys to carry out the selected adjustment.
When the menu adjustment is not displayed, the **P-** or **+** keys enable you to select the TV channels, the ◿ - or + keys to adjust the volume.

*The selected adjustment automatically switches off when no action has been executed for 10 seconds.*

# Connect Peripheral Equipment

There is a wide range of audio and video equipment that can be connected to your TV. The following connection diagrams show you how to connect them.

## Video recorder




Connect the aerial cables ①, ② and, to obtain the optimum picture quality, eurocable ③ as shown opposite.

*If your video recorder is provided with the EasyLink function, the eurocable supplied with it should be connected to* **EXTERNAL 2** *to benefit from the EasyLink functionality.*

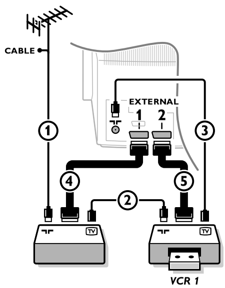
If the eurocable ③ is not used the following steps are required:

**Search for and store the test signal of the video recorder**

1. Unplug the aerial cable ① from the aerial socket ╥ of your video recorder.
2. Switch on your TV and put the video recorder on the test signal. (See the handbook for your video recorder.)
3. Search for the test signal of your video recorder in the same way as you searched for and stored the TV signals. See Installation, Searching for and storing TV channels, Manual installation, p. 5.
4. Store the test signal under programme number 0 or between 90 and 99.
5. Replace the aerial cable in the aerial socket ╥ of your video recorder after you have stored the test signal.

**Decoder and video recorder**
Connect a eurocable ④ to your decoder and to the special euroconnector of your video recorder. See also the video recorder handbook.
See Define Decoder/Descrambler prog. numbers, p. 7.
You can also connect your decoder directly to **EXTERNAL 1** or **2** with a eurocable.

### Video recorder and other peripherals (except Digital Sources)

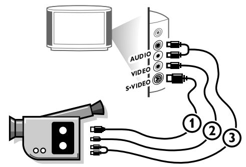



1. Connect the aerial cables ①, ② and ③ as shown opposite. Better picture quality can be obtained if you also connect eurocable ⑤ to **EXTERNAL 2** and a eurocable ④ to **EXTERNAL 1** or **EXTERNAL 3**.
2. Look for the test signal of your peripheral in the same way as you do for a video recorder.

*When a video recorder is connected to* **EXTERNAL 1** *you can only record a programme from your TV.*
*Only when a video recorder is connected to* **EXTERNAL 2** *it is possible to record a programme from your TV as well as from other connected equipment. See Record with your video recorder, p. 26.*

*Note: EXTERNAL 1 can handle CVBS and RGB, EXTERNAL 2 CVBS and Y/C and RGB, EXTERNAL 3 only CVBS.*

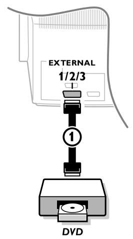
## Camera & camcorder




1. Connect your camera or camcorder to sockets at the right side of your TV.
2. Connect the equipment to **VIDEO** ② and **AUDIO L** ③ for mono equipment.
3. For stereo equipment also connect **AUDIO R** ③.

S-VHS quality with an S-VHS camcorder is obtained by connecting the S-VHS cables with the **S-VIDEO** input ① and **AUDIO** inputs ③.

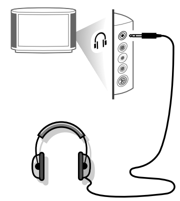
## Digital equipment (DVD, digital satellite tuner,...)




Connect your digital equipment with a eurocable ① to one of the euroconnectors (**EXT1**, **EXT2** or **EXT3**), or with a cinch cable to the **VIDEO** input at the right side of the TV (see illustration above).

*Note: the low quality of some digital picture material may be the cause of digital image distortion. In this case select* **Eco** *under the* **SMART PICTURE** ▭ *key on the remote control as this setting is intended to improve distorted picture quality.*

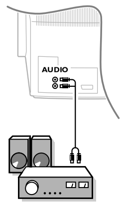
## Headphone



1. Insert the plug into the headphone socket 🎧 at the right side of the TV.
2. Press 🔇 on the remote control to switch off the internal loudspeakers of the TV.
*The headphone impedance must be between 8 and 4000 Ohm.*
*The headphone socket has a 3.5 mm jack.*

In the **SOUND** menu select **Headphone volume** to adjust the headphone volume, see p. 12.

## Audio equipment / Amplifier

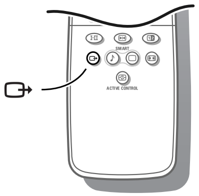



Connect the audio cables to the audio input of your audio equipment and to **AUDIO L** and **R** at the back of your TV.

You can listen to your TV sound via your audio equipment.

If you want to connect more equipment to your TV, consult your dealer.

## To select connected equipment



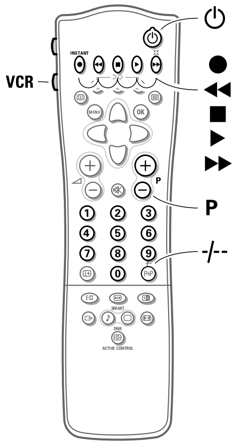
*If the TV is connected to a video recorder with the EasyLink function, in some cases the TV will be switched on, even when it was in standby. (E.g. playback tape,...)*
*This is not possible when Child lock On is selected.*

**Equipment connected with an aerial cable only :**
Select the programme number under which you have stored the test signal with the digit keys.

**Equipment connected to a euroconnector or to the right side of the TV**
Press the ⇨ key repeatedly to select **EXT1**, **EXT2, EXT3** or **FRONT**, according to where you connected your equipment at the back or the right side of your TV.
*Remark : Most equipment (decoder, video recorder, satellite receiver) carries out the switching itself.*

**If you want to change to TV channels?**
Enter the programme number of the TV channel which you want to watch with the digit keys or press the ⇨ key repeatedly to select **TV**.

## Audio and video equipment keys




Most of the audio and video equipment from our range of products can be operated with the remote control of your TV.

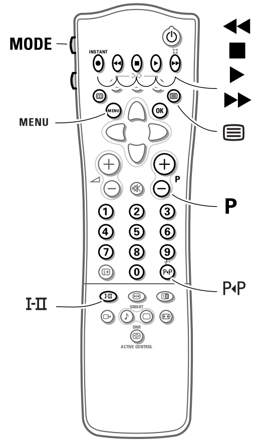
**Video recorder**
Keep the **VCR** key on the left side of the remote control pressed and simultaneously press:

- ● for record,
- ◀◀ for rewind,
- ■ for stop,
- ▶ for play,
- ▶▶ for fast forward,
- -/-- for selecting 1- or 2-digit programme numbers from the video recorder,
- - P + for sequential programme selection from the video recorder tuner,
- 0 to 9 to select a programme number from your video recorder tuner,
- ⏻ to switch the video recorder to standby

*These keys function with equipment which use the RC5 signalling standard.*

*If your video recorder has the EasyLink function, the key* **INSTANT** ● *for recording, can be operated in the TV mode.*
*If your EasyLink video recorder has the system standby function, when you press the ⏻ key for 3 seconds, both TV and the video recorder are switched to standby.*






**Satellite receiver**
Press the **OK** key simultaneously with the digit key 1.
Now you can operate your satellite receiver with the remote control of your TV.

Keep the **MODE** key on the left side of the remote control pressed and simultaneously press:

**MENU** to switch the **SAT** menu on or off

*These keys function with equipment which use the RC5 signalling standard.*

**DVD player**
Press the **OK** simultaneously with the digit key 2.
Now you can operate your DVD player with the remote control of your TV.

Keep the **MODE** key on the left side of the remote control pressed and simultaneously press:

- **MENU** to switch the DVD menu on or off
- ☰ to select a DVD title
- P◂P to select a DVD chapter
- I-II to select your choice of audio language
- ◀◀ to search down
- ■ stop
- ▶ play
- ▶▶ to search forward
- 0-9 to select a programme number from your DVD
- **OK** to enter the selected menu item

●, ⏻, ?, ⊜, ⇨ have no function

*Note: after replacing the batteries the default operational equipment is the satellite receiver.*

*These keys function with equipment which use the RC6 signalling standard.*

## Record with your video recorder

To record S-VHS quality, connect an S-VHS peripheral directly to the video recorder.

**Record a TV programme**

1. Select the programme number on your video recorder.
2. Set your video recorder to record.
   See the handbook for your video recorder.

*Switching programme numbers on your TV does not disturb recording !*

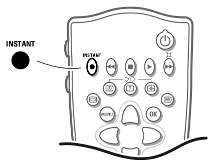
**Record a programme on your video recorder connected to EXTERNAL 2 from Audio/Video equipment connected to EXTERNAL 1, EXTERNAL 3 or to sockets on the right side of the TV**

1. Switch on the equipment.
2. Select the right external on your video recorder.
3. Set your video recorder to record.
   You record what you are watching on the screen.

*Do not switch programme numbers or do not switch off your TV when you are recording !*

## Record with your video recorder with EasyLink

*If you have connected an S-VHS video recorder provided with the EasyLink function, you can record S-VHS-quality from an S-VHS peripheral connected to the right side of the TV. (E.g. from an S-VHS camcorder.)*




*In TV mode, it is possible to start a direct recording of the programme which is being displayed on the TV screen.*
*Press the **INSTANT** ● record key of the remote control.*
*The video recorder switches on from standby and a message of what is being recorded appears on the screen.*
*The video recorder starts recording the programme you are watching.*
*Switching programme numbers on your TV does not disturb recording !*

*When recording a programme from a peripheral connected to EXTERNAL 1, 3 or FRONT, you can not select another TV programme on the screen.*
*To watch TV programmes again, press the programme number you want to select twice.*
*Attention: the recording is stopped and your video recorder switches to standby.*

## Record with your video recorder with NEXTVIEWLink

*If your video recorder is equipped with NEXTVIEWLink, and you tagged one or more programmes to be recorded automatically in the NEXTVIEW mode, it is not necessary for the TV to be in the standby mode or switched on for the recording to start.*

## Tips

**Care of the screen**
Clean the TV with a slightly damp soft cloth. Do not use abrasive solvent as it can damage the TV screen.

**Poor Picture**
- Have you selected the correct TV system?
- Is your TV or house aerial located too close to loudspeakers, non-earthed audio equipment or neon lights, etc.?
- Mountains or high buildings can cause double pictures or ghost images. Sometimes you can improve the picture quality by changing the direction of the aerial.
- Is the picture or teletext unrecognisable? Check if you have entered the correct frequency. See Installation, p. 5.
- Are brightness and contrast out of adjustment? Select Factory settings in the Setup menu, p. 7.
- Sometimes poor picture quality is possible when having activated an S-VHS camera or camcorder connected to the right side of your TV and another peripheral is connected to **EXT1** or **EXT2** at the same time. In this case switch off one of the other peripherals.

**No picture**
- Is the aerial connected properly?
- Are the plugs tightly connected in the aerial socket?
- Is the aerial cable in good condition and does it have suitable plugs?
- Are the connection facilities to a possible second TV in good condition? If in doubt, consult your dealer.

**No sound**
- No sound on any channel? Check the volume isn't at minimum.
- Is the sound interrupted with the mute key 🔇?

**Remote control**
If your TV no longer responds to the remote control, the batteries may be dead.
You can still use the **M** key and the -/+ keys at the top of your TV.

**Menu**
Have you selected the wrong menu? Press the **MENU** key again to exit from the menu.

**No solution**
Switch your TV off and then on again once.
**Never attempt to repair a defective TV yourself.**
Check with your dealer or call a TV technician.

**End of life directives**
Philips is paying a lot of attention to produce environmentally-friendly in green focal areas. Your new TV contains materials which can be recycled and reused.
At the end of its life specialised companies can dismantle the discarded TV to concentrate the reusable materials and to minimise the amount of materials to be disposed of.
Please ensure you dispose of your old TV according to local regulations.

**How to dispose of batteries?**
The batteries supplied do not contain the heavy metals mercury and cadmium. Nevertheless in many countries batteries may not be disposed of with your household waste. Please ensure you dispose of batteries according to local regulations.

## Index

## Glossary

**100 Hz**
100 Hertz provides a superior solution to the problem of picture flicker which is particularly noticeable with larger screen sizes. In a conventional TV, the picture area is scanned 50 times a second (50 Hertz) – a frequency which is still detectable by the human eye in the form of a flickering picture. In 100 Hertz sets, the picture area is scanned at a rate of 100 times per second (100 Hertz). At this frequency, the eye cannot detect flicker, resulting in a clearer picture which is more relaxing to the eye.

**Automatic Channel Installation (ACI)**
Automatically installs all TV channels in the same order as offered by your cable company, provided of course that the data is transmitted. It also automatically includes programme number and programme name.
With ACI, channel installation is fully automatic, simple and fast.

**Child lock**
Feature to prevent unauthorised use of your TV.

**Digital Scan**
If you look at a television screen you will see small imperfections in the picture caused by line vibration. Digital Scan (an internal process) removes interline flicker. When combined with 100 Hz, you will see a totally stable image.

**Easy Link**
Digital 'intelligent' ESI bus-system between TV and VCR (Scart connection required). Turns source selection and control into a one-button operation.

**Easy Text**
Teletext memory that automatically memorises Teletext pages and gives you instant access to them.

**Euroconnector**
A 21-pin connector system enabling you to simply connect various types of audio/video and computer equipment.

**Menu**
On-screen display of functions and facilities in a well-organised survey, which you can select using your remote control.

**NEXTVIEW**
NEXTVIEW is a new feature to assist the TV and VCR user in selecting the programmes she or he likes to watch from a television programme guide on the screen. It enables the user to see a description of every programme, and mark interesting programmes to be reminded (auto TV on) or recorded (NEXTVIEWLink video recorder required).

**NTSC**
The broadcasting system used in the USA, Japan and parts of South America and Southeast-Asia.

**Smart Picture and Sound controls**
Keys on the remote control to select predefined picture and sound settings.

**Sleeptimer**
Function with which you can set a time period after which the TV should switch itself to standby.

**Picture Freeze**
TV mode which allows you to "freeze" a certain image in order to study a specific detail at ease, e.g. to make notes of certain programme information like phone numbers.

**Teletext**
See also Easy Text
*WST*: World Standard Teletext.
*FLOF*: Full Level one Features. System applied by the BBC, RVE.... that provides a fast access to the teletext pages.
*TOP*: Table of (Teletext) Pages. German system for an easy access to the teletext pages.

**Tint**
TV-function to modify the general colour balance between cool and warm and to adjust it according to your personal preference.



**Table of TV frequencies.**
**Frequenztabelle der Fernsehsender.**
**Liste des fréquences des émetteurs.**
**Frequentietabel TV-Zenders.**
**Tabella delle frequenze delle trasmittenti.**
**Lista de las frecuencias de las emisoras.**
**Lista das frequências dos emissores.**
**Liste over TV senderne.**
**Tabell over TV-frekvenser.**
**Tabell över TV-frekvenser.**
**TV-taajuustaulukko.**
**Κατάλογος συχνοτήτων πομπών.**
**Список частот передатчиков.**
**A televizió–adóállomások frekvenciáinak a listája.**
**Lista częstotliwości stacji nadawczych.**
**Seznam frekvenčních pásem vysílačů.**
**Zoznam frekvenčných pásiem vysielačov.**

**EUROPE**

| CHANNEL | FREQ (MHz) |
|---|---|
| E2 | 48.25 |
| E3 | 55.25 |
| E4 | 62.25 |
| E5 | 175.25 |
| E6 | 182.25 |
| E7 | 189.25 |
| E8 | 196.25 |
| E9 | 203.25 |
| E10 | 210.25 |
| E11 | 217.25 |
| E12 | 224.25 |
| S1 | 105.25 |
| S2 | 112.25 |
| S3 | 119.25 |
| S4 | 126.25 |
| S5 | 133.25 |
| S6 | 140.25 |
| S7 | 147.25 |
| S8 | 154.25 |
| S9 | 161.25 |
| S10 | 168.25 |
| S11 | 231.25 |
| S12 | 238.25 |
| S13 | 245.25 |
| S14 | 252.25 |
| S15 | 259.25 |
| S16 | 266.25 |
| S17 | 273.25 |
| S18 | 280.25 |
| S19 | 287.25 |
| S20 | 294.25 |
| H1 | 303.25 |
| H2 | 311.25 |
| H3 | 319.25 |
| H4 | 327.25 |
| H5 | 335.25 |
| H6 | 343.25 |
| H7 | 351.25 |
| H8 | 359.25 |
| H9 | 367.25 |
| H10 | 375.25 |
| H11 | 383.25 |
| H12 | 391.25 |
| H13 | 399.25 |
| H14 | 407.25 |
| H15 | 415.25 |
| H16 | 423.25 |
| H17 | 431.25 |
| H18 | 439.25 |
| H19 | 447.25 |
| 21 | 471.25 |
| 22 | 479.25 |
| 23 | 487.25 |
| 24 | 495.25 |
| 25 | 503.25 |
| 26 | 511.25 |
| 27 | 519.25 |
| 28 | 527.25 |
| 29 | 535.25 |
| 30 | 543.25 |
| 31 | 551.25 |
| 32 | 559.25 |
| 33 | 567.25 |
| 34 | 575.25 |
| 35 | 583.25 |
| 36 | 591.25 |
| 37 | 599.25 |
| 38 | 607.25 |
| 39 | 615.25 |
| 40 | 623.25 |
| 41 | 631.25 |
| 42 | 639.25 |
| 43 | 647.25 |
| 44 | 655.25 |
| 45 | 663.25 |
| 46 | 671.25 |
| 47 | 679.25 |
| 48 | 687.25 |
| 49 | 695.25 |
| 50 | 703.25 |
| 51 | 711.25 |
| 52 | 719.25 |
| 53 | 727.25 |
| 54 | 735.25 |
| 55 | 743.25 |
| 56 | 751.25 |
| 57 | 759.25 |
| 58 | 767.25 |
| 59 | 775.25 |
| 60 | 783.25 |
| 61 | 791.25 |
| 62 | 799.25 |
| 63 | 807.25 |
| 64 | 815.25 |
| 65 | 823.25 |
| 66 | 831.25 |
| 67 | 839.25 |
| 68 | 847.25 |
| 69 | 855.25 |

**EASTERN EUROPE**

| CANAL | FREQ (MHz) |
|---|---|
| R1 | 49.75 |
| R2 | 59.25 |
| R3 | 77.25 |
| R4 | 85.25 |
| R5 | 93.25 |
| R 6 | 175.25 |
| R 7 | 183.25 |
| R 8 | 191.25 |
| R 9 | 199.25 |
| R10 | 207.25 |
| R11 | 215.25 |
| R12 | 223.25 |
| S1 | 105.25 |
| S2 | 112.25 |
| S3 | 119.25 |
| S4 | 126.25 |
| S5 | 133.25 |
| S6 | 140.25 |
| S7 | 147.25 |
| S8 | 154.25 |
| S9 | 161.25 |
| S10 | 168.25 |
| S11 | 231.25 |
| S12 | 238.25 |
| S13 | 245.25 |
| S14 | 252.25 |
| S15 | 259.25 |
| S16 | 266.25 |
| S17 | 273.25 |
| S18 | 280.25 |
| S19 | 287.25 |
| S20 | 294.25 |
| H1 | 303.25 |
| H2 | 311.25 |
| H3 | 319.25 |
| H4 | 327.25 |
| H5 | 335.25 |
| H6 | 343.25 |
| H7 | 351.25 |
| H8 | 359.25 |
| H9 | 367.25 |
| H10 | 375.25 |
| H11 | 383.25 |
| H12 | 391.25 |
| H13 | 399.25 |
| H14 | 407.25 |
| H15 | 415.25 |
| H16 | 423.25 |
| H17 | 431.25 |
| H18 | 439.25 |
| H19 | 447.25 |
| 21 | 471.25 |
| 22 | 479.25 |
| 23 | 487.25 |
| 24 | 495.25 |
| 25 | 503.25 |
| 26 | 511.25 |
| 27 | 519.25 |
| 28 | 527.25 |
| 29 | 535.25 |
| 30 | 543.25 |
| 31 | 551.25 |
| 32 | 559.25 |
| 33 | 567.25 |
| 34 | 575.25 |
| 35 | 583.25 |
| 36 | 591.25 |
| 37 | 599.25 |
| 38 | 607.25 |
| 39 | 615.25 |
| 40 | 623.25 |
| 41 | 631.25 |
| 42 | 639.25 |
| 43 | 647.25 |
| 44 | 655.25 |
| 45 | 663.25 |
| 46 | 671.25 |
| 47 | 679.25 |
| 48 | 687.25 |
| 49 | 695.25 |
| 50 | 703.25 |
| 51 | 711.25 |
| 52 | 719.25 |
| 53 | 727.25 |
| 54 | 735.25 |
| 55 | 743.25 |
| 56 | 751.25 |
| 57 | 759.25 |
| 58 | 767.25 |
| 59 | 775.25 |
| 60 | 783.25 |
| 61 | 791.25 |
| 62 | 799.25 |
| 63 | 807.25 |
| 64 | 815.25 |
| 65 | 823.25 |
| 66 | 831.25 |
| 67 | 839.25 |
| 68 | 847.25 |
| 69 | 855.25 |

**FRANCE**

| CANAL | FREQ (MHz) |
|---|---|
| 2 | 55.75 |
| 3 | 60.50 |
| 4 | 63.75 |
| 5 | 176.0 |
| 6 | 184.0 |
| 7 | 192.0 |
| 8 | 200.0 |
| 9 | 208.0 |
| 10 | 216.0 |
| B | 116.75 |
| C | 128.75 |
| D | 140.75 |
| E | 159.75 |
| F | 164.75 |
| G | 176.75 |
| H | 188.75 |
| I | 200.75 |
| J | 212.75 |
| K | 224.75 |
| L | 236.75 |
| M | 248.75 |
| N | 260.75 |
| O | 272.75 |
| P | 284.75 |
| Q | 296.75 |
| H1 | 303.25 |
| H2 | 311.25 |
| H3 | 319.25 |
| H4 | 327.25 |
| H5 | 335.25 |
| H6 | 343.25 |
| H7 | 351.25 |
| H8 | 359.25 |
| H9 | 367.25 |
| H10 | 375.25 |
| H11 | 383.25 |
| H12 | 391.25 |
| H13 | 399.25 |
| H14 | 407.25 |
| H15 | 415.25 |
| H16 | 423.25 |
| H17 | 431.25 |
| H18 | 439.25 |
| H19 | 447.25 |
| 21 | 471.25 |
| 22 | 479.25 |
| 23 | 487.25 |
| 24 | 495.25 |
| 25 | 503.25 |
| 26 | 511.25 |
| 27 | 519.25 |
| 28 | 527.25 |
| 29 | 535.25 |
| 30 | 543.25 |
| 31 | 551.25 |
| 32 | 559.25 |
| 33 | 567.25 |
| 34 | 575.25 |
| 35 | 583.25 |
| 36 | 591.25 |
| 37 | 599.25 |
| 38 | 607.25 |
| 39 | 615.25 |
| 40 | 623.25 |
| 41 | 631.25 |
| 42 | 639.25 |
| 43 | 647.25 |
| 44 | 655.25 |
| 45 | 663.25 |
| 46 | 671.25 |
| 47 | 679.25 |
| 48 | 687.25 |
| 49 | 695.25 |
| 50 | 703.25 |
| 51 | 711.25 |
| 52 | 719.25 |
| 53 | 727.25 |
| 54 | 735.25 |
| 55 | 743.25 |
| 56 | 751.25 |
| 57 | 759.25 |
| 58 | 767.25 |
| 59 | 775.25 |
| 60 | 783.25 |
| 61 | 791.25 |
| 62 | 799.25 |
| 63 | 807.25 |
| 64 | 815.25 |
| 65 | 823.25 |
| 66 | 831.25 |
| 67 | 839.25 |
| 68 | 847.25 |
| 69 | 855.25 |

**ITALY**

| CANALE | FREQ (MHz) |
|---|---|
| A | 53.75 |
| B | 62.25 |
| C | 82.25 |
| D | 175.25 |
| E | 183.75 |
| F | 192.25 |
| G | 201.25 |
| H | 210.25 |
| H1 | 217.25 |
| S1 | 105.25 |
| S2 | 112.25 |
| S3 | 119.25 |
| S4 | 126.25 |
| S5 | 133.25 |
| S6 | 140.25 |
| S7 | 147.25 |
| S8 | 154.25 |
| S9 | 161.25 |
| S10 | 168.25 |
| S11 | 231.25 |
| S12 | 238.25 |
| S13 | 245.25 |
| S14 | 252.25 |
| S15 | 259.25 |
| S16 | 266.25 |
| S17 | 273.25 |
| S18 | 280.25 |
| S19 | 287.25 |
| S20 | 294.25 |
| H1 | 303.25 |
| H2 | 311.25 |
| H3 | 319.25 |
| H4 | 327.25 |
| H5 | 335.25 |
| H6 | 343.25 |
| H7 | 351.25 |
| H8 | 359.25 |
| H9 | 367.25 |
| H10 | 375.25 |
| H11 | 383.25 |
| H12 | 391.25 |
| H13 | 399.25 |
| H14 | 407.25 |
| H15 | 415.25 |
| H16 | 423.25 |
| H17 | 431.25 |
| H18 | 439.25 |
| H19 | 447.25 |
| 21 | 471.25 |
| 22 | 479.25 |
| 23 | 487.25 |
| 24 | 495.25 |
| 25 | 503.25 |
| 26 | 511.25 |
| 27 | 519.25 |
| 28 | 527.25 |
| 29 | 535.25 |
| 30 | 543.25 |
| 31 | 551.25 |
| 32 | 559.25 |
| 33 | 567.25 |
| 34 | 575.25 |
| 35 | 583.25 |
| 36 | 591.25 |
| 37 | 599.25 |
| 38 | 607.25 |
| 39 | 615.25 |
| 40 | 623.25 |
| 41 | 631.25 |
| 42 | 639.25 |
| 43 | 647.25 |
| 44 | 655.25 |
| 45 | 663.25 |
| 46 | 671.25 |
| 47 | 679.25 |
| 48 | 687.25 |
| 49 | 695.25 |
| 50 | 703.25 |
| 51 | 711.25 |
| 52 | 719.25 |
| 53 | 727.25 |
| 54 | 735.25 |
| 55 | 743.25 |
| 56 | 751.25 |
| 57 | 759.25 |
| 58 | 767.25 |
| 59 | 775.25 |
| 60 | 783.25 |
| 61 | 791.25 |
| 62 | 799.25 |
| 63 | 807.25 |
| 64 | 815.25 |
| 65 | 823.25 |
| 66 | 831.25 |
| 67 | 839.25 |
| 68 | 847.25 |
| 69 | 855.25 |

**GB**
The frequencies used by a cable company may differ from the frequencies on the table. Consult your cable company or your dealer for detailed information.

**D**
In Kabelfernsehanlagen können Abweichungen von den in den Frequenztabellen aufgeführten Frequenzen vorkommen. Bitte wenden Sie sich an Ihren Fachhändler oder Ihre Kabelfernsehgesellschaft, die Ihnen die zutreffenden Frequenzen mitteilt.

**F**
Les fréquences utilisées par une société de télédistribution peuvent être différentes de celles sur la liste des fréquences. Consultez votre société de télédistribution ou votre revendeur pour des informations plus détailées.

**NL**
De frequenties die gebruikt worden door een kabelmaatschappij kunnen verschillen van deze op de tabel. Raadpleeg uw kabelexploitant of uw handelaar voor meer informatie.

**I**
Le frequenze usate per una società di teledistribuzione possano essere differenti di quelle nella tabella. Consultate la società di teledistribuzione o il vostro rivenditore per informazione specifica.

**E**
Las frecuencias utilizadas por las empresas de distribución de señal por cable, pueden ser diferentes de las que se encuentran en esta tabla. Consulte con su compañia de distribución de televisión por cable o con su distribuidor para que le proporcionen una información más detallada.

**P**
As frequências utilizadas por uma sociedade de teledistribuição podem ser diferentes das indicadas na lista de frequências. Consultar a sociedade de teledistribuição ou o vendedor para informações mais detalhadas.

**DK**
Frekvenser benyttet af kabel operatører kan være afvigende fra disse, kantakt deres kabel operatør eller forhandler for næmere informa-tion.

**N**
Frekvensene som benyttes pa et kabelnett kan avvike fra de som er oppfört i tabellen. Kontakt ditt kabel-TV selskap eller din forhandler for næmere opplysninger.

**S**
Frekvenserna som används i kabel-TV-näten kan avvika från frekvenserna i tabellen. Kontakta ditt kabel-TV-bolag eller din radiohandlare för vidare information.

**SF**
Kaapeliyhtiöden käyttämät taajuudet voivat poiketa taulukossa olevista taajuuksista. Tarkat tiedot saat kaapeliyhtiösta tai myyjältä.

**GR**
Οι συχνότητες που χρησιμοποιούνται από μια εταιρεία τηλεμετάδοσης είναι δυνατόν να είναι διαφορετικές από αυτές που περιέχει ο κατάλογος. (Συμβουλευθείτε την εταιρεία τηλεμετάδοσης ή τον πωλητή για λεπτομερέστερες πληροφορίες).

**CEI**
Частоты на которых передаëт телакампания могут отличаться от частот на данной таблице. (Обратиться к Вашей телекампании или Вашему продавцу за дополнительной информацией.

**H**
Egy televizió–adóállomás sugárzáshoz használt frekvenciatartományai lehetnek a táblázatban közöltektől eltérőek is. (Abban az esetben, ha bővebb információkra van szüksége, forduljon az eladóhoz.)

**PL**
Operator sieci telewizyjnej może stosować inne częstotliwości, niż te, które figurują na tablicy (bardziej szczegółowych informacji na ten temat zasięgnąć u operatora lub sprzedawcy).

**CZ**
Frekvence používané některými televizními společnost–mi se mohou lišit od údajů uvedených v tomto seznamu. Informujte se blíže u příslušné společnosti nebo v prode–jně, kde jste televizor koupili.

**SK**
Frekvencie používané niektorými spoločnosťami televízneho prenosu sa môžu lišiť od údajov uvedených v tomto zozname. Informujte sa bližšie u príslušnej spoločnosti alebo v predajni, kde ste televízor kúpili.

# 4. Mechanical Instructions

**Note:** Figures below can deviate slightly from the actual situation, due to the different set executions.

## 4.1 Access to the Service Connector (for ComPair)

1. Remove the 'Service Connector' cover (see Figure 4.1).
2. Connect the ComPair cable (for more info, see chapter 5).
3. Start ComPair and perform the diagnosis.

## 4.2 Rear Cover Removal

1. Remove all fixation screws [A] of the rear cover.
2. Use a knife (or other thin blade) to release the four fixation clamps [B] at the top of the TV-set. Press down until you here a click.
3. Now remove the rear cover.

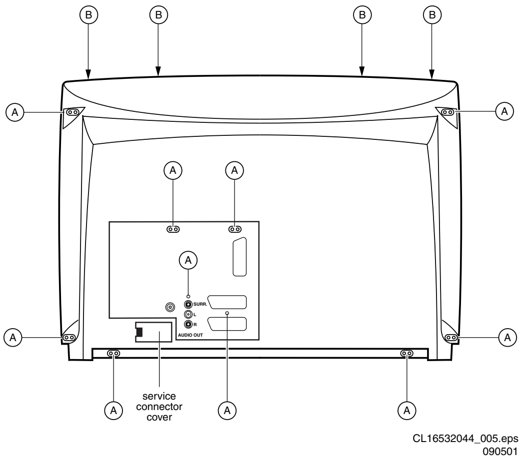



Figure 4-1 .eps

## 4.3 Print Removal

### 4.3.1 Large Signal Panel (LSP)

Service position 1: For better accessibility of the LSP, do the following (see Figure 4.2):
1. Remove the LSP-bracket from the bottom tray by pulling it backwards.
2. Hook the bracket in the first row of fixation holes of the bottom tray. In other words, reposition the bracket from [1] to [2].

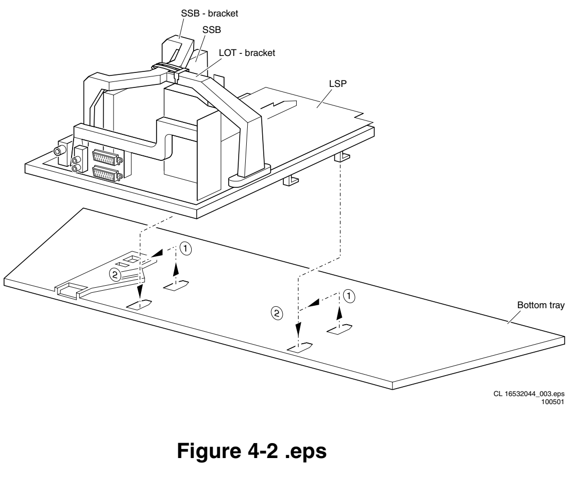



Figure 4-2 .eps

Service position 2: To get access to the bottom side (solder side) of the LSP, do the following (see Figure 4.3):
1. To disconnect the degaussing coil from the LSP, remove the cable from connector 1502 [1].
2. Release the wiring from their fixation clamps, in order to get room for repositioning the LSP.
3. Flip the LSP 90 degrees clockwise [2], and place it in the fixation hole at the left side of the bottom tray [3].

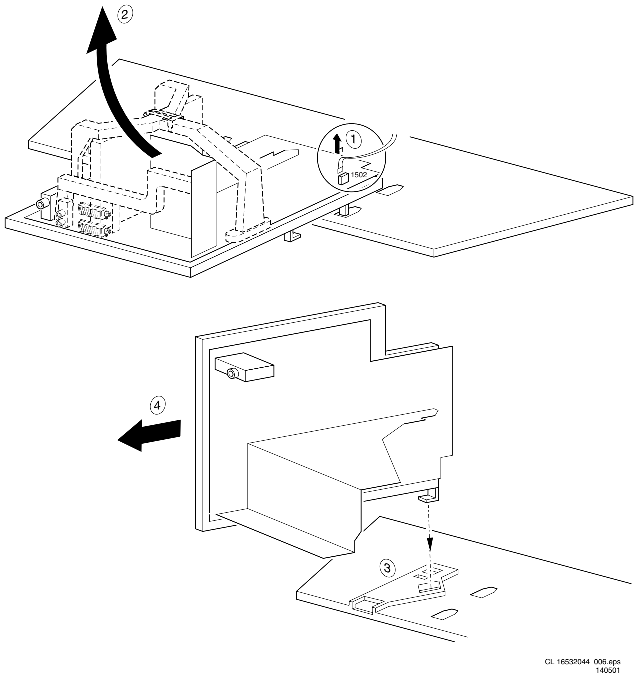



Figure 4-3 .eps

### 4.3.2 3rd SCART Panel

To remove the 3rd SCART module, do the following:
1. Remove the fixation screw [1].
2. To release the fixation peg, push it towards the CRT [2].
3. At the same time, pull the complete module away from the LSP [3]. It hinges in the LSP-bracket.
4. To remove the panel, disconnect the flat-cable from connector 1680 and remove the four panel screws [4].

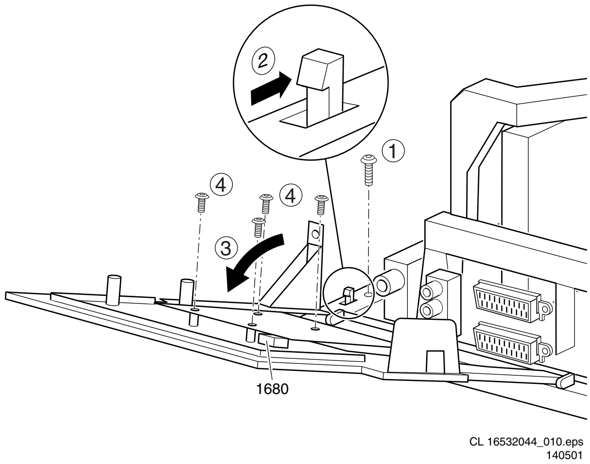



Figure 4-4 .eps

### 4.3.3 Small Signal Board (SSB)

In fact, there is no predefined service position for the SSB. Most test points are located on the A-side (side that is facing the tuner).
If you have to replace ICs, you must take the complete SSB module out of the SIMM-connector.

To get access to the SSB test points, do the following:
1. Put the LSP in service position 1 (as described above).
2. Remove the fixation screw, which holds the SSB-bracket [1].
3. Release the clamping jaw at the top of the SSB bracket [2] and [3].
4. Push the two clamping lugs outwards, and pull the top of the bracket at the same time upwards [4] and [5].
5. Now you can remove the complete bracket. Push it, at the height of the LSP-bracket, towards the CRT [6] and lift it out of the LSP-bracket [7].

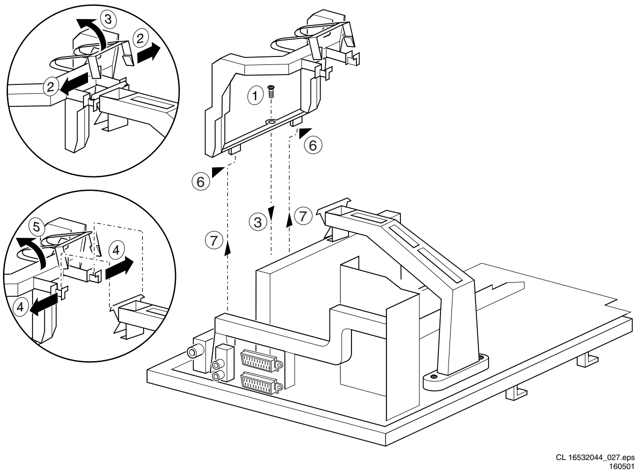



Figure 4-5 .eps

1. Push the top of the SSB towards the LOT [1].
2. Due to the pressure, the two metal clamps at both sides of the SIMM-connector will release [2].
3. Take the complete SSB out [3].

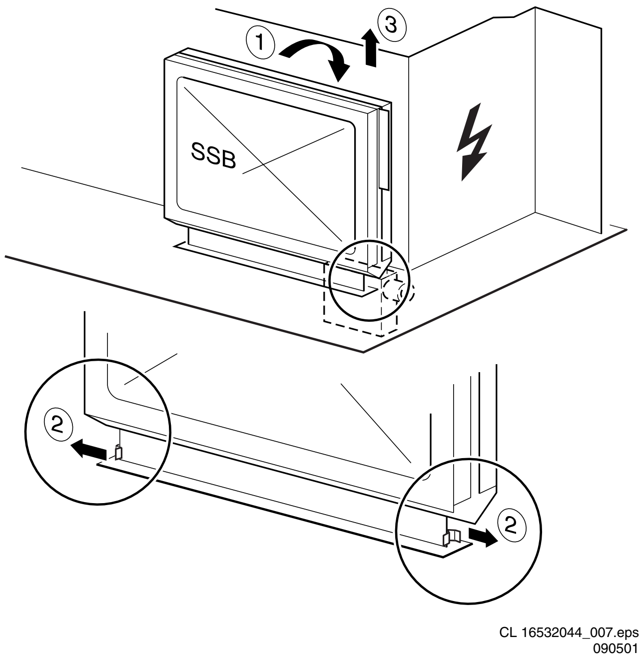



Figure 4-6 .eps

1. Once you have taken out the SSB, remove the A-side shielding [2]. Sometimes it is necessary to unsolder some solder-tags first [1].
2. Now replace the SSB module in the SIMM-connector in reverse order.

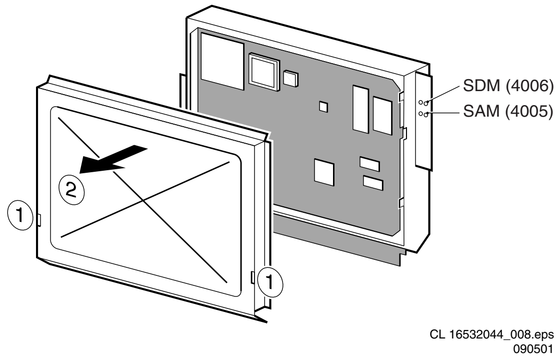



Figure 4-7

**Note 1**: For better access to the SSB, it is possible to order an ‘extension board’ under number 9965 000 07933.
**Note 2**: If necessary for the measurement, put the LSP in 'service position 2' (as described above).

### 4.3.4 Top Control Panel

1. Remove the two fixation screws.
2. Pull the board backward.

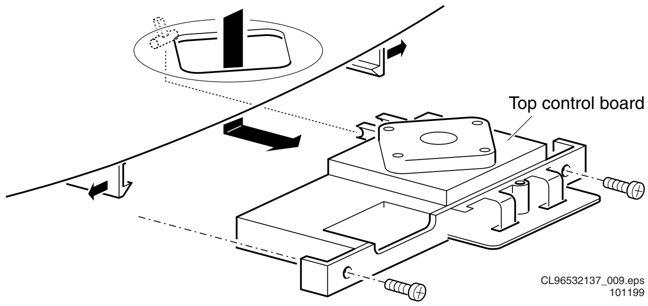



Figure 4-8

### 4.3.5 Side I/O Panel

1. Remove the two fixation screws [1].
2. Push the panel door inside and fix it in the lock [2].
3. Pull the module backward [3].
4. Now release the fixation clamps, in order to remove the print from its bracket.

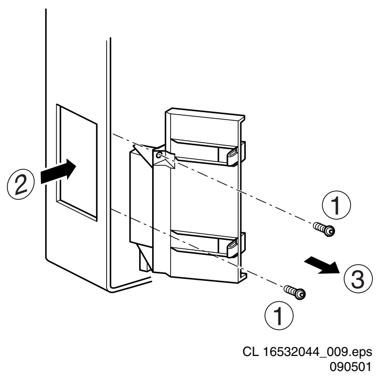



Figure 4-9 .eps

#### 4.3.6 DAF Panel

1. Remove the fixation screw [1].
2. Push down the fixation clamp [2], and pull the complete bracket at the same time away from the CRT [3]. The module is now free from the LSP-bracket.
3. Release the fixation clamps [4], in order to remove the print from its bracket.

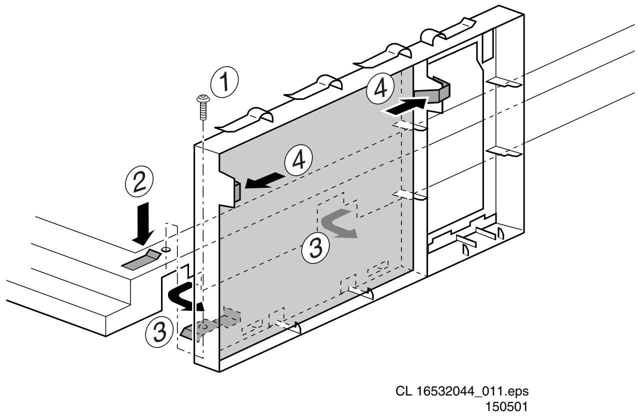



Figure 4-10 .eps

#### 4.3.7 Mains Switch / LED Panel

1. Release the two fixation clamps by pushing them upward [1].
2. At the same time, pull the complete assy backward [2].
3. Now release the two fixation clamps [3], in order to remove the print from its bracket [4].

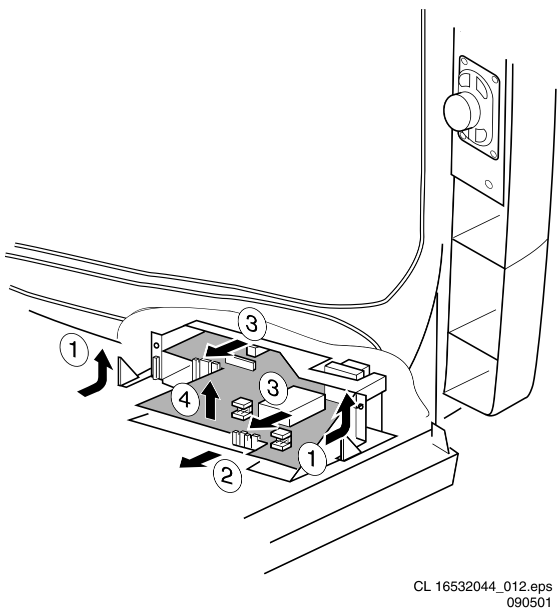



Figure 4-11 .eps

**Note**: If necessary, you can replace the light guide.

## 4.4 Rear Cover Assembly

Before you re-assemble the rear cover, perform the following checks:

- Check whether the mains cord is mounted correctly in the guiding brackets.
- Check whether all cables are placed in fixation clamps. This is very important due to the large 'hot' area of the set.

# 5. Service Modes, Error Codes and Fault Finding

Index of this chapter:
1. Test points.
2. Service Modes.
3. Problems and solving tips (related to CSM).
4. ComPair.
5. Error buffer.
6. The blinking LED procedure.
7. Protections.
8. Repair tips.

## 5.1 Test Points

The chassis is equipped with test points printed on the circuit board assemblies. They refer to the diagram letters. The numbering is in a logical sequence for diagnostics. Always start diagnosing (within a functional block), in the sequence of the relevant test points for that block.

Measurements are performed under the following conditions:
- Service Default Mode.
- Video: colour bar signal.
- Audio: 3 kHz left, 1 kHz right.

## 5.2 Service Modes

Service Default Mode (SDM) and Service Alignment Mode (SAM) offer several features for the service technician, while the Customer Service Menu (CSM) is used for communication between dealer and customer.

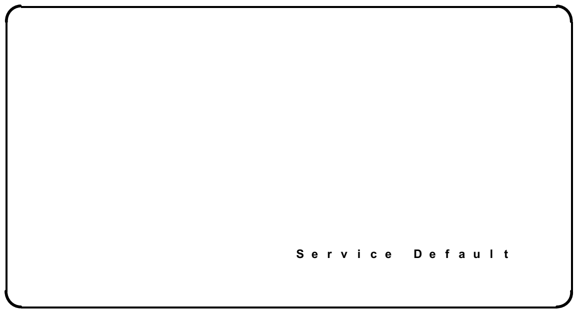
### 5.2.1 Service Default Mode (SDM)

***Purpose***
- To create a pre-defined setting, to get the same measurement results as given in this manual.
- To override SW protections.
- To start the blinking LED procedure.

***Specifications***
- Tuning frequency: 475.25 MHz for PAL/SECAM.
- Colour system: SECAM L for France or PAL B/G for the rest of Europe.
- All picture settings at 50 % (brightness, colour, contrast).
- All sound settings at 50 %, except volume at 25 %.
- All service-unfriendly modes (if present) are disabled, like:
  – (sleep) timer,
  – child/parental lock,
  – blue mute,
  – automatic volume limiter (AVL),
  – auto switch-off (when no ‘IDENT’ video signal was received for 10 minutes),
  – skip/blank of non-favorite pre-sets,
  – smart modes,
  – auto store of personal presets,
  – auto user menu time-out.

***How to enter SDM***
Use one of the following methods:
- Via a standard customer RC-transmitter : key in the code ‘062596’ followed by the ‘MENU’ button (it is possible that, together with the SDM, the main menu will appear. To switch it off, push the ‘MENU’ button again).
- When you press the ‘DEFAULT’ button on the Dealer Service Tool (DST or RC7150) while the set is in the normal operation mode.
- When you shorten for a moment (*) the two solder pads on the ‘external part’ of the SSB print (see Figure 7 in Chapter 4), with the indication SDM (item 4006). Activation can be performed in all modes, except when the set has a problem with the main-processor.
- Via ComPair.

*** Caution:** If the SDM is entered via the pins, all the software-controlled protections are de-activated.
After entering SDM, the following screen will be shown, with ‘Service Default’ at the lower right side for recognition.




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140501

**Figure 5-1**

***How to navigate***
When you press the ‘MENU’ button on the RC transmitter, the set will toggle between the SDM and the normal user menu (with the SDM mode still active in the background).

***How to exit SDM***
Use one of the following methods:
- Switch the set to STANDBY (⏻) via the RC-transmitter, or
- Press the ‘EXIT’ button on the DST.

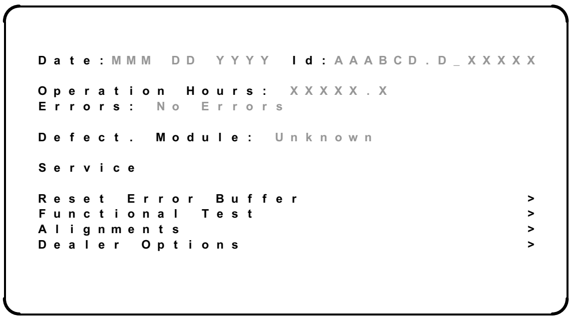
### 5.2.2 Service Alignment Mode (SAM)

***Purpose***
- To perform alignments.
- To change option settings.
- To display/clear the error code buffer.

***Specifications***
- Operation hours counter.
- Software version.
- Option settings.
- Error buffer reading and erasing.
- Software alignments.

***How to enter SAM***
Use one of the following methods:
- Via a standard RC transmitter: key in the code ‘062596’ directly followed by the OSD [i+] button, or
- When you press the ALIGN button on the DST while the set is in the normal operation mode, or
- When you shorten for a moment (*) the two solder pads on the ‘external part’ of the SSB print (see Figure 7 in Chapter 4), with the indication SAM (item 4005). Activation can be performed in all modes, except when the set has a problem with the main-processor.
- Via ComPair.

*** Caution:** If the SAM is entered via the pins, all the software controlled protections are de-activated.
The following screen will be shown, with SAM at the upper right side for recognition.




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**Figure 5-2**

- **Date** Displays the software date.
- **ID** Displays the software version of the ROM. Example: EM3E11.0_01234 (AAABCD.D_XXXXX)
  - A = the chassis name (EM3).
  - B = the region: E = Europe, A = Asia Pacific, U = NAFTA, L = LATAM.
  - C = the language cluster number.
  - D = the main software version number.
  - X = latest 5 digits of 12nc code software.
- **SAM** Indication of the actual mode.
- **Operation Hours** Displays the accumulated total of operation hours (not the standby hours).
- **Errors** (followed by maximal 10 errors) The most recent error is displayed at the upper left (for an error explanation see paragraph 5.5.4).
- **Defect. Module** Here the module that generates the error is displayed. If there are multiple errors in the buffer that have not all been generated by a single module, there is probably another defect. It will then display the message 'Unknown' here.
- **Reset Error Buffer** When you press the 'OK' button, the error buffer is reset.
- **Functional Test** All devices are tested via the 'OK' button. Eventual errors are displayed in the error buffer. The error buffer is not erased, the content returns when this test is terminated.
- **Alignments** This will activate the Alignments sub-menu.
- **Dealer Options** Extra features for the dealers.
- **Errors** (followed by maximal 10 errors) The most recent error is displayed at the upper left (for an error explanation see paragraph 5.5.4).
- **Defect. Module** Here the module that generates the error is displayed. If there are multiple errors in the buffer that have not all been generated by a single module, there is probably another defect. It will then display the message 'Unknown' here.
- **Reset Error Buffer** When you press the 'OK' button, the error buffer is reset.
- **Functional Test** All devices are tested via the 'OK' button. Eventual errors are displayed in the error buffer. The error buffer is not erased, the content returns when this test is terminated.
- **Alignments** This will activate the Alignments sub-menu.
- **Dealer Options** Extra features for the dealers.

***How to navigate***

- In SAM, you can select the menu items with the CURSOR UP/DOWN key on the RC-transmitter. The selected item will be highlighted. When not all menu items fit on the screen, move the CURSOR UP/DOWN key to display the next/previous menu items.
- With the CURSOR LEFT/RIGHT keys, it is possible to:
  - (De)activate the selected menu item.
  - Change the value of the selected menu item.
  - Activate the selected submenu.
- When you press the MENU button twice, the set will switch to the normal user menus (with the SAM mode still active in the background). To return to the SAM-menu press the 'OSD [i+]' button.
- When you press the 'MENU' key in a submenu, you will return to the previous menu.

***How to exit SAM***

Use one of the following methods:

- Press the 'MENU' button on the RC-transmitter, or
- Switch the set to STANDBY (⏻) via the RC-transmitter, or
- Press the 'EXIT' button on the DST.

### 5.2.3 Customer Service Mode (CSM)

***Purpose***

When a customer is having problems with his TV-set, he can call his dealer. The service technician can than ask the customer to activate the CSM, in order to identify the status of the set. Now, the service technician can judge the severness of the complaint. In a lot of cases he can advise the customer how to solve the problem, or he can decide if it is necessary to visit the customer.
The CSM is a read only mode, therefore modifications in this mode are not possible.

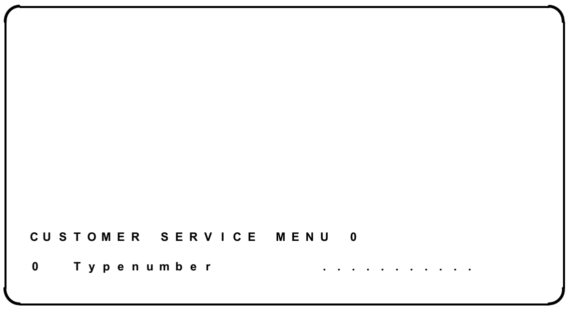
***How to enter CSM***

Use one of the following methods:

- Press the 'MUTE' button on the RC-transmitter **simultaneously** with the 'MENU' button on the TV (top control) for, at least 4 seconds.
- Key in the code '123654' via the standard RC transmitter.

**Note 1:** Activation of the CSM is only possible if there is no (user) menu on the screen !
**Note 2:** If you do not point the RC-transmitter correctly to the RC-receiver in the set, and you push the 'MENU' button for more than 6 s, the TV starts in 'demo' mode. To leave this mode, push 'MENU' again for more than 6 s.

After activation of the Customer Service Menu, the following screen (Customer Service Menu 0) will appear:




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**Figure 5-3**

- Line 0 - **Type number** (e.g. 28PW8807/12) This information is very helpful for a helpdesk/workshop as reference for further diagnosis. In this way, it is not necessary for the customer to look at the rear of his TV-set.

By means of the 'CURSOR-DOWN' knob on the RC-transmitter the Customer Service Menu 1 will appear. By means of the 'CURSOR-UP' knob on the RC-transmitter the Customer Service Menu 0 will appear again.

Customer Service Menu 1 represents following information:

```
CUSTOMER SERVICE MENU 1

1    SW Version          ............
2    Code 1              ... ... ... ...
3    Code 2              ... ... ... ...
4    LS Volume           ..
5    LS Brightness       ..
6    LS Contrast         ..
7    LS Colour           ..
8    LS Headphone        ..
9    Sharpness           ..
10   Dolby               .....
11   Surround Mode       ............
11a  Tuner Frequency     ............
```

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140501

**Figure 5-4**

- Line 1 - **Software version** (e.g. EM3E11.0_XXXXX) The build in software version. You will find details of the software versions in the chapter 'Software Survey' of the 'Product Survey - Colour Television' publication. This publication is generated four times a year.
- Line 2 - **Code 1** Gives the last 5 errors of the error buffer. As soon as the built-in diagnose software has detected an error the buffer is adapted. See paragraph 5.5.4 for a description.
- Line 3 - **Code 2** Gives the first 5 errors of the error buffer. As soon as the built-in diagnose software has detected an error the buffer is adapted. The last occurred error is displayed on the leftmost position of code 2. Each error code is displayed as a 3 digit number. When less than 10 errors occur, the rest of the line(s) is (are) empty. In case of no errors the text 'No Errors' is displayed. See paragraph 5.5.4 for a description.
- Line 4 - **LS Volume** Gives the Last Status of the volume as set by the customer for this selected transmitter. The value can vary from 0 (volume is minimum) to 36 (volume is maximum). Volume values can be changed via the volume key on the RC-transmitter.
- Line 5 - **LS Brightness** Gives the Last Status of the brightness as set by the customer for this selected transmitter. The value can vary from 0 (brightness is minimum) to 63 (brightness is maximum). Brightness values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'BRIGHTNESS'.
- Line 6 - **LS Contrast** Gives the Last Status of the contrast as set by the customer. The value can vary from 0 (contrast is minimum) to 63 (contrast is maximum). Contrast values can be changed via 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'CONTRAST'.
- Line 7 - **LS Colour** Gives the Last Status of the colour saturation, as set by the customer. The value can vary from 0 (colour is minimum) to 63 (colour is maximum). Colour values can be changed via 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'COLOUR'.
- Line 8 - **LS Headphone** Gives the Last Status of the headphone volume, as set by the customer. The value can vary from 0 (volume is minimum) to 24 (volume is maximum). Headphone volume values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'SOUND' and 'HEADPHONE'.
- Line 9 - **Sharpness** Gives the sharpness value. The value can vary from 0 (sharpness is minimum) to 7 (sharpness is maximum). In case of bad antenna signals a too high value of the sharpness can result in a noisy picture. Sharpness values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'SHARPNESS'.
- Line 10 - **Dolby** Indicates whether the received transmitter transmits Dolby sound (present) or not (not present). Attention: The presence of Dolby can only be tested by the software on the Dolby Signalling bit. If a Dolby transmission is therefore received without a Dolby Signalling bit, then this indicator will show 'not present' even though such a Dolby transmission is received.
- Line 11 - **Surround Mode** Indicates the by the customer selected surround mode (or automatically chosen mode). In case the set is a Non-Dolby set there will be displayed '0'. If it is a Dolby-set then is displayed: 'Stereo', 3D Surround', 'Dolby Pro Logic', 'Dolby 3 Stereo' or 'Hall'. These settings can be influenced by toggling the surround mode button on remote control (white button). It can also have been selected automatically by signalling bits (internal software
- Line 11a - **Tuner Frequency** Indicates the frequency the selected transmitter is tuned to. The tuner frequency can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys for fine tune or by entering directly with the digit keys 0 to 9 on the RC-transmitter after opening the installation menu and selecting 'MANUAL INSTALLATION'. The installation menu can be opened by pressing 'TIMER' and 'ENLARGE' at the same time.

By means of the 'CURSOR-DOWN' knob on the RC-transmitter the Customer Service Menu 2 will appear. By means of the 'CURSOR-UP' knob on the RC-transmitter the Customer Service Menu 1 will appear again.

Customer Service Menu 2 represents following information:

```
CUSTOMER SERVICE MENU 2

13   Centre Volume       ..
14   DNR                 ...
15   Noise Figure        ..
16   Digital Option      ..
17   Colour System       .....
18   TV System           .....
19   Audio System        .....
20   Tuned bit           .....
21   Speaker Config.     ............
22   Digital Sources     ............
```

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**Figure 5-5**

- Line 13 - **Centre Volume** Not valid in this chassis. Must be 0.
- Line 14 - **DNR** Not valid.
- Line 15 - **Noise Figure** Gives the noise ratio for the selected transmitter. This value can vary from 0 (good signal) to 127 (average signal) and to 255 (bad signal).
- Line 16 - **Digital Option** Gives the selected digital mode, '100 HZ', 'DIGITAL SCAN', 'NATURAL MOTION' or 'DOUBLE LINES'. Change via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter, after pressing the 'MENU' button and selecting 'PICTURE', 'DIGITAL OPTIONS'.
- Line 17 - **Colour System** Gives information about the colour system of the selected transmitter.
  - Black and white: No colour carrier received
  - PAL: PAL signal received
  - SECAM: SECAM signal received
  - NTSC: NTSC signal received
- Line 18 - **TV System** Gives information about the video system of the selected transmitter.
  - BG: BG signal received
  - DK: DK signal received
  - I: PAL I signal received
  - L: SECAM L signals received

  - M38.9: NTSC M signal received with video carrier on 38.9 MHz
- Line 19 - **Audio System** Gives information about the audio system of the selected transmitter.
  - Sound Muted: No sound
  - Dolby Pro Logic: Dolby Pro Logic sound received
  - Mono: Mono sound received
  - Stereo: Stereo sound received
  - Dual I: Language I received
  - Dual II: Language II received
  - Digital Mono: Digital mono sound is received
  - Digital Stereo: Digital stereo sound is received
  - Digital Dual I: Digital language I is received
  - Digital Dual II: Digital language II is received
- Line 20 - **Tuned bit** Gives information about the tuning method of the stored pre-set. If a channel is found via 'automatic installation' you will see the value 'Off'. When you change this (automatically found) frequency via 'fine tune' adjustment (installation menu - manual installation), the displayed value will change to 'On'. So when you see the value 'On' in this line, it is an indication that the received channel is a non-standard signal (e.g. of a VCR).
- Line 21 - **Speaker config.** Gives the speaker configuration settings. In case the set is a non-Dolby set, it displays '0'. If it is a Dolby-set, it displays: 'FULL INTERNAL', 'L/R EXTERNAL', 'SURROUND EXTERNAL' or 'FULL EXTERNAL'. Change the speaker configuration (for a Dolby-set), via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-handset after opening the 'INSTALLATION' menu and selecting 'SETUP'. Open the 'INSTALLATION' menu by pressing the 'TIMER' and 'ENLARGE' buttons at the same time.
- Line 22 - **Digital Sources** Gives the configuration setting for the digital source. It displays: 'FRONT', 'EXT1', 'EXT2', 'EXT3' or 'NONE'. If one of these is selected, the starting point is a top quality signal on that input and a number of settings are therefore changed automatically. Change the digital source via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after opening the installation menu and selecting 'SETUP'. The installation menu can be opened by pressing 'TIMER' and 'ENLARGE' at the same time.

***How to exit CSM***

Use one of the following methods:

- After you press a key on the RC-transmitter (with exception of the 'CHANNEL' and 'VOLUME' keys), or
- After you switch the TV-set 'OFF' with the mains switch.

## 5.3 Problems and Solving Tips (related to CSM)

**Note:** Below described problems are all related to the TV settings. The procedures to change the value (or status) of the different settings, are described above.
The new value(s) are automatically stored.

### 5.3.1 Picture Problems

***Worse picture quality in case of DVD pictures***

Check line 22 'Digital sources'. In case line 22 gives the indication 'Not Present', change the setting into 'Present' (via the 'installation' menu).

***Snowy/noisy picture***

1. Check line 15 'Noise Figure'. In case the value is 127 or higher and the value is also high on other programs, check the aerial cable/aerial system.
2. Check lines 9 'Sharpness' and 15 'Noise Figure'. In case the value of line 9 is 3 or 4 and the value of line 15 is high (127 or higher), decrease the 'Sharpness' value.

***Picture too dark***

1. Press 'Smart Picture' button on the RC-transmitter. In case the picture improves, increase the 'Brightness' or the 'Contrast' value. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.
2. Check lines 5 'LS Brightness' and 6 'LS Contrast'. If the value of line 5 is low (< 10) or the value of line 6 is low (< 10), increase the 'Brightness' or the 'Contrast' value.

***Picture too bright***

1. Press 'Smart Picture' button on the RC-transmitter. In case the picture improves, decrease the 'Brightness' or the 'Contrast' value. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.
2. Check lines 5 'LS Brightness' and 6 'LS Contrast'. If the value of line 5 is high (> 40) or the value of line 6 is high (< 50). Decrease the 'Brightness' value or increase the 'Contrast' value.

***White line around picture elements and text***

1. Press 'Smart Picture' button on the Remote Control. In case the picture improves, decrease the 'Sharpness' value. The new value is automatically stored (in 'personal' pre-set) for all TV channels.
2. Check line 9 'Sharpness'. Decrease the 'Sharpness' value. The new value is automatically stored for all TV channels.

***No picture***

Check line 20 'Tuned bit'. In case the value is 'On', install the required program again. Open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation.

***Blue picture***

No proper signal is received. Check the aerial cable/aerial system.

***Blue picture and/or unstable picture***

A scrambled or decoded signal is received.

***Black and white picture***

Check line 7 'LS Colour'. In case the value is low (< 10) increase the 'Colour' value. The new value is automatically stored for all TV channels.

***No colours/colour lines around picture elements***

1. Check lines 17 'Colour System' and 18 'TV System'. If a 'strange' system pop's up, something has gone wrong during installation. Re-install the channel.
2. In case line 17 is 'PAL' and line 18 is 'L', the installed system for this pre-set is 'France', while 'West Europe' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select system 'West Europe'.

***Colours not correct***

Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'PAL' and line 18 is 'L', the installed system for this pre-set is 'France', while 'West Europe' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; West Europe'.

***Colours not correct/unstable picture***

Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'SECAM' and line 18 is 'BG', the installed system for this pre-set is 'West Europe', while 'France' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; France'.

***Unstable picture***
Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'SECAM' and line 18 is 'M 38,9', the installed system for this pre-set is 'West Europe', while 'France' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; France'.

***Menu text not sharp enough***
1. Press 'Smart Picture' button on the RC-transmitter. In case picture improves, Decrease the contrast value. The new value(s) are automatically stored for all TV channels.
2. Check line 7 'LS Contrast'. The value of line 7 is high (> 50). Decrease the contrast value.

### 5.3.2 Sound Problems

***No sound from left and right speaker***
1. Check line 4 'LS Volume'. The value is low. Increase the value of 'Volume'. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.

***Sound too loud for left and right speaker***
1. Check line 4 'LS Volume'. The value is high. Decrease the value of 'LS Volume'. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.

## 5.4 ComPair

### 5.4.1 Introduction

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development on the European DST (service remote control), which allows faster and more accurate diagnostics. ComPair has three big advantages:
- ComPair helps you to quickly get an understanding on how to repair the chassis in a short time by guiding you systematically through the repair procedures.
- ComPair allows very detailed diagnostics (on $I^2C$ level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about $I^2C$ commands yourself because ComPair takes care of this.
- ComPair speeds up the repair time since it can automatically communicate with the chassis (when the microprocessor is working) and all repair information is directly available. When ComPair is installed together with the SearchMan electronic manual of the defective chassis, schematics and PWBs are only a mouse click away.

### 5.4.2 Specifications

ComPair consists of a Windows based faultfinding program and an interface box between PC and the (defective) product. The ComPair interface box is connected to the PC via a serial or RS232 cable.
In case of the EM3E chassis, the ComPair interface box and the TV communicate via a bi-directional service cable via the service connector.

The ComPair faultfinding program is able to determine the problem of the defective television. ComPair can gather diagnostic information in two ways:
- Automatic (by communication with the television): ComPair can automatically read out the contents of the entire error buffer. Diagnosis is done on $I^2C$ level. ComPair can access the $I^2C$ bus of the television. ComPair can send and receive $I^2C$ commands to the micro controller of the television. In this way, it is possible for ComPair to communicate (read and write) to devices on the $I^2C$ busses of the TV-set.
- Manually (by asking questions to you): Automatic diagnosis is only possible if the micro controller of the television is working correctly and only to a certain extends. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions (e.g. *Does the screen give a picture? Click on the correct answer: YES / NO*) and showing you examples (e.g. *Measure test-point I7 and click on the correct oscillogram you see on the oscilloscope*). You can answer by clicking on a link (e.g. text or a waveform picture) that will bring you to the next step in the faultfinding process.

By a combination of automatic diagnostics and an interactive question / answer procedure, ComPair will enable you to find most problems in a fast and effective way.

Beside fault finding, ComPair provides some **additional features** like:
- Up- or downloading of pre-sets.
- Managing of pre-set lists.
- Emulation of the Dealer Service Tool (DST).
- If both ComPair and SearchMan (Electronic Service Manual) are installed, all the schematics and the PWBs of the set are available by clicking on the appropriate hyperlink.
  Example: *Measure the DC-voltage on capacitor C2568 (Schematic/Panel) at the Monocarrier. Click on the 'Panel' hyperlink to automatically show the PWB with a highlighted capacitor C2568. Click on the 'Schematic' hyperlink to automatically show the position of the highlighted capacitor.*

### 5.4.3 Stepwise Start Up / Shut Down

Under normal circumstances, a fault in the power supply, or an error during start-up, will switch the television to protection mode. ComPair can take over the initialisation of the television. In this way it is possible to distinguish which part of the start-up routine (hence which circuitry) is causing the problem.

***Stepwise start up explanation***
This is realised via ComPair and is very helpful when a **protection** is activated (see also chapter 5.7).

| State | Description mode | Display LED (Red) | Enabled protection |
|---|---|---|---|
| 0 | Low power stdby: 5V2/3V3 present, uP in stdby-mode | On | None |
| 1 | High power Stdby: TV-set in stdby-mode | Wait 1s, flash 1 x | None |
| 2 | SSB is powered by stdby-supply (5V/8V). Degaussing (12 s) has been activated. | Wait 1s, flash 2 x | 4 & 5 |
| 3 | Semi stdby-mode: HIP, HOP, MSP and Tuner initialized leading to semi stdby-mode. | Wait 1s, flash 3 x | Plus 1, 6 & 18 |
| 4 | All ICs are initialized, HOP activates the main supply, EHT-generation starts, black current stabilization is on | Wait 1s, flash 4 x | Plus 2 & 16 |
| 5 | TV On: TV-set operates, un-blanked picture. | Wait 1s, flash 5 x | |

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**Figure 5-6**

***Stepwise shut down explanation***

In the stepwise shutdown mode, state 2 is skipped (it is not possible to de-initialise ICs).

| State | Description mode | Display LED (Red) | Disabled protections |
|---|---|---|---|
| 5 | TV On: TV-set operates, un-blanked picture | Wait 1s, flash 5 x | - |
| 3 | Semi stdby-mode: SSB is powered by the stdby-supply | Wait 1s, flash 3 x | 18, 16, 6, 2 & 1 |
| 1 | High power stdby: TV-set in stdby-mode | Wait 1s, flash 1 x | 4 & 5 |
| 0 | Low power stdby: 5V2/3V3 present, uP in stdbymode | On | |

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**Figure 5-7**

**Note:** When the set is in stepwise mode and, due to stepping-up, a protection is activated, the set will really go into protection (blinking red LED). The set will not leave the stepwise-mode however. By stepping up, the set can be activated again, until state X where the protection was activated. At state (X-1) diagnostic measurements can be performed.

### 5.4.4 How To Connect

1. First install the ComPair Browser software (see the Quick Reference Card for installation instructions).
2. Connect the RS232 interface cable between a free serial (COM) port of your PC and the PC connector (marked with ‘PC’) of the ComPair interface.
3. Connect the mains adapter to the supply connector (marked with ‘POWER 9V DC’) of the ComPair interface.
4. Switch the ComPair interface ’OFF’.
5. Switch the television set ‘OFF’ with the mains switch.
6. Connect the ComPair interface cable between the connector on the rear side of the ComPair interface (marked with ‘$I^2C$’) and the ComPair connector at the rear side of the TV (situated just below the tuner input, see also chapter 4).
7. Plug the mains adapter in a mains outlet, and switch the interface ‘ON’. The green and red LEDs light up together. The red LED extinguishes after approx. 1 second while the green LED remains lit.
8. Start the ComPair program and read the ‘Introduction’ chapter.

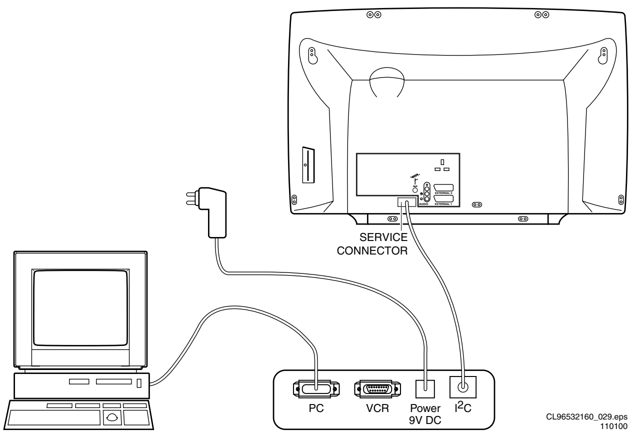



**Figure 5-8**

### 5.4.5 How To Order

ComPair order codes:
- Starter kit ComPair + SearchMan software + ComPair interface (excluding transformer): 4822 727 21629
- ComPair interface (excluding transformer): 4822 727 21631
- Starter kit ComPair software (registration version): 4822 727 21634
- Starter kit SearchMan software: 4822 727 21635
- ComPair CD (update): 4822 727 21637
- SearchMan CD (update): 4822 727 21638
- ComPair interface cable: 3122 785 90004

## 5.5 Error Buffer

### 5.5.1 Introduction

The error code buffer contains all detected errors since the last time the buffer was erased. The buffer is written from left to right. When an error occurs that is not yet in the error code buffer, it is written at the left side and all other errors shift one position to the right.

### 5.5.2 How to Read the Error Buffer

Use one of the following methods:
- On screen via the SAM (only if you have a picture). Examples:
  – ERROR: 0 0 0 0 0 : No errors detected
  – ERROR: 6 0 0 0 0 : Error code 6 is the last and only detected error
  – ERROR: 9 6 0 0 0 : Error code 6 was first detected and error code 9 is the last detected (newest) error
- Via the blinking LED procedure (when you have no picture). See next paragraph.
- Via ComPair.

### 5.5.3 How to Clear the Error Buffer

Use one of the following methods:
- By activation of the ‘RESET ERROR BUFFER’ command in the SAM menu:
- When you transmit the commands ‘DIAGNOSE’ - ‘99’ - ‘OK’ with ComPair (or with a DST).
- If the content of the error buffer has not changed for 50 hours, it resets automatically.

### 5.5.4 Error Codes

In case of non-intermittent faults, clear the error buffer before you begin the repair. These to ensure that old error codes are no longer present.

If possible, check the entire contents of the error buffer. In some situations an error code is only the result of another error code and not the actual cause (e.g., a fault in the protection detection circuitry can also lead to a protection).

| Error | Device | Description | Defective item | Diagram | Defect. module indication |
|---|---|---|---|---|---|
| 1 | ST24E32 | NVM, spontaneous blinking 1-1-1.. | 7011 | B5 | Control |
| 2 | H fail protection | HFB | | | Horizontal Flyback<br>Or HW-protection due to:<br>- ARC_PROT<br>- BRIDGE_PROT<br>- NON_VFB PROT |
| 3 | SAA4978 | PICNIC | 7709 | B3 | Feature Box |
| 4 | Supply 5 V | 5V2 protection | | B5 | +5 V Supply |
| 5 | Supply 8 V | 8V6 protection | | B5 | +8 V Supply |
| 6 | Slow $I^2C$-bus blocked | Slow $I^2C$-bus blocked, spontaneous blinking 6-6-6.. | | | Slow $I^2C$ blocked |
| 7 | TDA9330 | HOP video control/geometry | 7301 | B4 | Video Controller |
| 8 | TDA9320 | HIP I/O video processing | 7323 | B2 | Chroma IF IO |
| 9 | PCF8574 | Wireless expander | | | |
| 10 | Reserved | | | | |
| 11 | Reserved | | | | |
| 12 | TDA9178 | LTP Peaking | | | Video Controller |
| 13 | UV1316/TEDE9 | Tuner | U1200 | A8 | Tuner |
| 14 | MSP34xx | Sound processor + Dolby | 7651 | B6 | Audio Module |
| 15 | Reserved | | | | |
| 16 | Featurebox protection | Featurebox protection | | B3 | +3 V (FBX) supply |
| 17 | Reserved | | | | |
| 18 | Fast $I^2C$-bus blocked | Fast $I^2C$-bus blocked, spontaneous blinking 18-18-18.. | | | Fast $I^2C$ blocked |

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**Figure 5-9**

**Note:** Error codes 1, 6 or 18 are protection codes and in this case, supplies of some circuits will be switched off. Also in protection, the LED will blink the number of times equivalent to the most recent error code.

## 5.6 The Blinking LED Procedure

### 5.6.1 Introduction

Via this procedure, you can make the contents of the error buffer visible via the front LED. This is especially useful for fault finding, when there is no picture.

When the SDM is entered, the front LED will show (blink) the contents of the error-buffer. Error-codes ≥ 10 are shown as follows:
– a long blink of 750 ms (which is an indication of the decimal digit),
– a pause of 1.5 s,
– n short blinks (where n = 1 - 9),
– when all the error-codes are displayed, the sequence finishes with a LED blink of 3 s,
– the sequence starts again.

Example: Error **12 9 6 0 0**.
After activation of the SDM, the red front LED will show:
– 1 long blink of 750 ms (which is an indication of the decimal digit) followed by a pause of 1.5 s,
– 2 short blinks followed by a pause of 3 s,
– 9 short blinks followed by a pause of 3 s,
– 6 short blinks followed by a pause of 3 s,
– 1 long blink of 3 s to finish the sequence,
– the sequence starts again.

**Note 1:** If errors 1, 6 or 18 occur, the LED ***always*** gives the last occurred error even if the set is NOT in service mode.
**Note 2:** If on the DST the text 'ERROR 2' is displayed, the communication from the TV to the DST has failed.

### 5.6.2 How to Enter

Use one of the following methods:
- Enter the SDM. The blinking red front LED will show the contents of the error buffer (this works only in 'normal operation' mode).
- Transmit the commands 'DIAGNOSE' - '0' - 'OK' with a DST/ComPair (this works both in 'Standby mode' and 'protection' mode). The complete error buffer is shown.
- Via the 'DIAGNOSE' - 'X' - 'OK' function on the DST/ ComPair (where X is a number between 1 and 5):
  1. Press the 'DIAGNOSE' button on the DST (possible in all modes except SAM).
  2. Press '1' to view the last detected error (or '2', etc. to show the errors before).
  3. Press the 'OK' button. The red front LED will now give the requested error.

## 5.7 Protections

### 5.7.1 Introduction

The EM3E has only one micro-processor (OTC), which remains active during Standby. This because power of the microprocessor and the attached memory chip set is coming from the 3V3 supply, which is derived from the 5V Standby-circuitry (via stabiliser 7005). So in both Power-on as in Standby mode the microprocessor is connected to this power supply.

If a fault situation is detected, an error code will be generated and if necessary, the set is put in protection mode. The protection mode is indicated by the blinking of the red front LED at a frequency of 3 Hz (or by a coded blinking in special cases). In some error cases however, the micro processor does not put the set in the protection mode (this is the case with the - hardware - loudspeaker protection of the audio amplifier).

The content of the error buffer can be read via the service menu (SAM), the blinking LED procedure or via DST/ ComPair.
The DST/ComPair 'diagnose' functionality will force the set into the 'Service Standby', which is alike the usual Standby, however the microprocessor remains completely in normal operation.

To get a quick diagnosis the EM3E has 3 service-modes implemented:

- The Customer Service Mode (CSM).
- The Service Default Mode (SDM). Start-up of the set in a predefined way.
- The Service Alignment Mode (SAM). In this mode items of the set can be adjusted via a menu and with the help of test patterns.

Both SDM & SAM modes can be entered via the 'service pads' on the SSB (see Figure 4-7), via an RC-transmitter (DST or standard RC) or via ComPair. It is not possible to enter the SAM in Standby, the set has to be in 'normal operation' mode.

The EM3E 'Protection Diagram' shows the structure of the protection system. See diagram below.

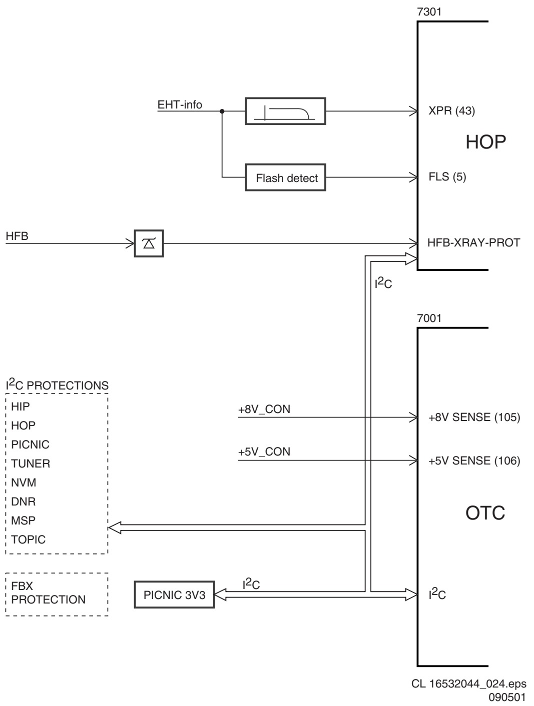



**Figure 5-10**

There are several types of protections:

- I$^2$C related protections.
- OTC related protections (via polling on I/O pins or via algorithms).
- HOP related protections (mainly for deflection items).
- Hardware errors that are not sensed by the OTC (e.g. BRIDGECOIL_PROT, NON_VFB, ARC_PROT).

All protections are explained below.

### 5.7.2 I$^2$C Related Protections

In normal operation, some registers of the I$^2$C controlled ICs are refreshed every 200 ms. During this sequence, the I$^2$C busses and the I$^2$C ICs are checked.
An I$^2$C protection will take place if the SDA and SCL lines are short-circuited to ground, or to each other. An I$^2$C error will also occur, if the power supply of the IC is missing (e.g. FBX_PROT (error 16)).

### 5.7.3 OTC Related Protections

If a protection is detected at an OTC input, the OTC will start to scan all protection inputs every 200 ms for 5 times. If the protection on one of the inputs is still active after 1 s, the µP will put the set in the protection mode. Before the scanning is started, a so called 'ESD refresh' is carried out. This is done, because the interrupt on one of the inputs is possibly caused either by a flash or by ESD. As a flash or ESD can influence IC settings, the HOP, HIP, MSP, PICNIC, NVM and Tuner are initialised again, to ensure the normal picture and sound conditions of the set.

**8 V and 5 V protection:** The µP senses the presence of the 8 V and 5 V (via the '+5V_CON' and '+8V_CON' lines). If one (or both) of these voltages is (are) not present, an error code is stored in the error buffer of the NVM, and the set is put in the protection mode.

### 5.7.4 HOP Related Protections

Every 200 ms, the status register of the HOP is read by the OTC (via the I$^2$C bus). If a protection signal is detected on one of the inputs of the HOP, the relevant error bit in the HOP register is set to 'high'. If this error bit is still 'high' after 1 s, the OTC will store the error code in the error buffer of the NVM and, depending on the relevancy of the error bit, the set will either go into the protection mode or not.

The following protections are implemented:

- **HFB (Horizontal Flyback):** If the horizontal flyback is not present, this is detected via the HOP (HFB_X-RAY_PROT). One status bit is set to 'high'. The error code is stored in the error buffer and the set will go into the protection mode.
- **Flash detection:** When a flash is detected via the EHT-info line (via D6303 and T7303), the H-drive (and so the Line output stage) is stopped immediately. The FLS-bit in the HOP status register is set to 'high'. As the duration of a flash is very short, the FLS-bit is re-set to 'low' again after the flash refresh, and via a 'slow start' the set will start again.

### 5.7.5 Hardware Related Protections

Due to the architecture (with 'hot' deflection) there are some protections that can not be sensed by the microprocessor. Three of these protections will lead to a protection on set level (Standby mode and blinking LED), while another will only lead to a circuit protection.

***TV-set Protection***
The following fault conditions will lead to a 'complete' set protection:

- **BRIDGECOIL protection:** This is sensed via the 'EW' signal going to the base of TS7652 (via R3495 and D6499). In a normal situation, the voltage on C2498 (diagram A4) is high, TS7652 is conducting. When bridge coil 5422 (diagram A3) is short circuited, the voltage on C2498 changes to low, which will block TS7652. In this case, also TS7641 will block and the voltage on 2642 will rise until TS7443 is forced in conduction. The 'SUP-ENABLE' signal (in normal operating condition -20 V) is shorted now to ground level, which will force the Main Power Supply to Standby mode.
- **ARC protection:** If there are 'open' connections (e.g. bad solder joints) in the *high energy* deflection circuitry, this can lead to damaging effects (read: fire). For that reason, the E/W current is sensed (via 3479//3480). If this current becomes too high, the 'thyristor' circuit (TS7653 and TS7654) is triggered. TS7442 is switched 'on' and TS7443 is forced into conduction. . The 'SUP-ENABLE' signal is shorted now to ground level, which will force the Main Power Supply to Standby mode.

- **NON_VFB (No vertical Flyback) protection.** If the frame stage generates no pulses, TS7641 will block. TS7443 is now switched 'on', which will lead to Standby mode. So in normal operation condition, TS7641 and TS7652 are conducting, while TS7443 is blocked.

***Circuit Protection***

The following fault condition will lead to a 'partly' set protection:

- **PROT1 protection:** When a DC-voltage (positive or negative) is sensed on one of the loudspeaker outputs, the protection circuit (TS7704, 7705, 7706 and 7707), will put the IC7700 in Standby mode (via tri-state input pin 6). For more details see chapter 9.

## 5.8 Repair Tips

### 5.8.1 Miscellaneous

The relay you hear when you switch the set 'on' (from Standby or via the mains switch), is from the degaussing circuitry. It is not used for switching the Power Supply (as done in the MG-chassis).

Take care not to touch the 'hot' heatsink while disconnecting the SSB, despite the fact that the mains cord is out of the mains socket. There can still be an annoying rest-voltage on the heatsink for a short while. This, because the discharge resistors 3502 and 3503 (on the LSP between hot and cold part) are not stuffed for Europe.
Instead, discharge resistors 3066 and 3057 on the Mains Switch panel are used, but because they are located before the Mains switch, they only discharge when this switch is 'on'.
**Advice**: when you remove the SSB, disconnect the Mains cord, but keep the Mains switch 'on'.

Do not try to measure on the SSB side, which is facing the 'hot' heatsink. This is dangerous. Most service test points are guided to the 'tuner' side and are indicated by the 'service' printing. Where the circuitry was too 'crowded' for this printing, you can find the correct location on the 'test point overviews' in this manual (chapter 6).

A very large part of the LSP is '**hot**', such as:

- the primary part of the Standby Supply,
- the whole Main supply (except for the secondary Audio supply),
- and the complete deflection circuitry (so notice that the deflection coil is hot !!).

### 5.8.2 Start-up Sequence

The start up sequence differs from other sets (e.g. MG-sets or EM2E-sets):

1. When the set is switched 'on', the 5 and 8 V lines ('+5V_CON' and '+8V_CON') of the standby power supply are activated.
2. After they are sensed by the OTC, the µP will address the HOP via the $I^2C$-bus, to start the drive [1].
3. Via the 'SUP-ENABLE' signal, the Main Supply is switched 'on' and will deliver the VBAT to the Line deflection stage [2].
4. EHT generation is now started.
5. The OTC will un-blank the picture.
6. When you switch 'off' the set, this is done in a controlled way via the POR signal [3].

**Note:** Standby is not directly achieved via the Standby line of the microprocessor, but indirectly via the HOP circuitry.

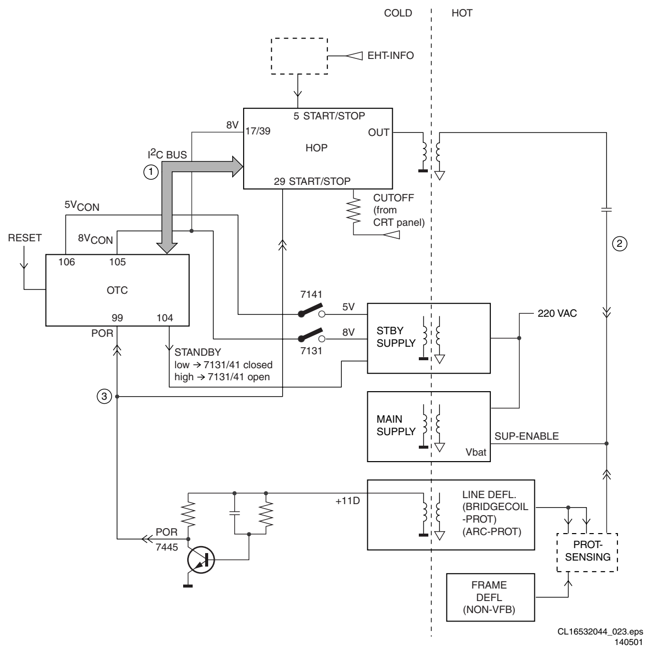



**Figure 5-11**

### 5.8.3 ComPair

This chassis does not have an IR transmitting LED (as in MG-sets). Therefore a 'Service' (ComPair) connector is implemented at the rear side of the set, which is directly accessible (as in EM2E-sets). In addition to this, there is also a blinking LED procedure to show the contents of the error buffer.

When you use ComPair, you have the possibility to activate a 'stepwise start-up' mode. With this mode, you can initiate the start-up sequence step by step. This also means that in certain steps, some protections are not activated. This is sometimes very convenient during repair (see also paragraph 5.4.3).

### 5.8.4 Protections

There are 'service pads' implemented on the SSB (items 4005 and 4006, outside the shielding), to force the set in SDM or SAM (see also Fig. 7 in Chapter 4). This will overrule the processor-controlled protections, but not the hardware protections. This means, that the A/D-input protections (5 and 8 V) and the $I^2C$ 'not-acknowledging' info from the feature box (FBX) are overruled. **Caution:** When doing this, the service technician must know what he is doing, as it could lead to damaging the set.

The 'ARC'- and/or 'BRIDGECOIL' protection are hardly ever triggered, however:

- When you suspect the 'ARC' protection, look for bad solderjoints and smell. By interrupting resistor 3497, this protection is disabled (special attention needed !).
- When you suspect the 'BRIDGECOIL' protection, which can also be due to a too wide picture amplitude, shorten G and S of of the E/W MOSFET 7480. This will disable the protection. You will now have a minimal horizontal amplitude. Re-align the horizontal amplitude in the SAM menu and remove the G/S short of TS7480.

### 5.8.5 Main Supply

- The simplest way is, to replace the components of the Main Supply with repair kit (3122 785 90310)
- More detailed way:

– Replace FET 7504 and zener 6505.
– Remove the SSB panel.
– Short B and E of TS7529, in order to put the Main Supply in 'on'-mode (TS7529 is blocking then). **Caution:** To prevent that this will damage R3403 and TS7443, **first disable the HW-protection of the deflection circuit.** Therefor short circuit C2642 on the LSP (diagram A4)
– Attach a load of 500 Ω to VBAT capacitor C2515 (the supply can not work without a minimum load).
– Use a variac, and slowly increase the VMAINS. Measure over sensing resistors R3514//15 if a nice sawtooth voltage becomes available.
– Also measure the VBAT . This may never exceed +141 V. If it does, there is something wrong in the feedback circuitry (e.g. regulator 7506).

- **Note:** Be careful when measuring on the gate of FET TS7504. This circuitry is very high-ohmic and can easily be damaged (first connect ground to measuring equipment, than measure the gate).

### 5.8.6 Standby Supply

The simplest way is to replace the components of the Standby Supply with repair kit 3122 785 90320.

### 5.8.7 Line Deflection

The simplest way is to replace the components of the Line Deflection circuitry with repair kit 3122 785 90330.

### 5.8.8 Frame Deflection

**Caution:** When the Frame Deflection circuitry is suspected, one must be careful. Because there is a DC-voltage on the frame deflection, the beam current could damage the CRT neck, leading to a defective CRT.

Best thing to do is:
1. Interrupt the resistors 3403 and 3404 on the CRT panel (diagram F), in order to remove the 'filament' voltage from the tube (no beam current, so no chance of destroying the CRT).
2. Interrupt resistor 3403 on the LSP (diagram A4) to disable the 'SUP-ENABLE' line.
3. Measure with a multimeter, or better with a oscilloscope, the functionality of the Frame stage.
4. After you've found the cause, exchange the defective component (e.g. TDA8177), and re-solder the interrupted resistors.

| Phenomenon | Possible Cause | Repair tip |
|---|---|---|
| No picture, no LED. | Standby Supply defective. | Measure circuitry (see diagram A2). Start at test-point A19.<br>When the Mains switch is 'on', this voltage must always be available |
| No picture, no LED. | Bad connection of SSB in SIMM-connector. | In case of a bad connection, it can happen that there is no picture, and that the Standby LED is not controllable. Re-place the SSB. |
| No picture, red LED blinking at 3 Hz. | Set is in protection due to various causes. For error codes see error-code list. | You have no picture, so:<br>- or you read the error buffer via ComPair<br>- or you read the blinking LED information via 'diagnose'-'x'-'ok' on DST<br>- or you read the error code sequence via 'diagnose'-'0'-'ok' with the DST.<br>When you have found the error, check the circuitry related to the supply voltage and $I^2C$-communication or the circuitry that triggers the protection. |
| No picture, red LED blinking with code 6-6-6 or 18-18-18. | No communication on slow $I^2C$- or fast $I^2C$-bus. | As processor cannot communicate with one of the 2 busses it the standby-led spontaneously starts blinking 6-6-6… or 18-18-18….<br>If in the error buffer somewhere is an error 6 or 18, these will have the highest priority starting the mentioned blinking.<br>Measure dependent of the error on the $I^2C$-bus which device is loading the bus. (use $I^2C$ -overview) |
| No picture, red LED blinking with code 1-1-1. | No communication on NVM-$I^2C$ bus to the µP. | As the µP cannot communicate with the NVM $I^2C$ bus, it spontaneously starts blinking 1-1-1. Note: when there is no access to the NVM, a lot of picture setting can go wrong. |
| No picture, no sound. Set is making audible squeaking sound | Supply is possibly in hiccup-mode, which is audible via a squeaking supply transformer. | Possible causes:<br>- $V_{BAT}$ is shorted (caused by short circuited line transistor 7421), or<br>- Sound winding is shorted (amplifier is shortening the power supply lines), or<br>- D6514 is shorted (due to a too high $V_{BAT}$).<br>Remove excessive load, to see what causes the failure, or check feedback circuit. See repair tip 'Main Power Supply' (supply needs a minimal load). |
| No picture, no sound. Green LED works fine | Supply does not work correctly. | If e.g. $V_{BAT}$ is only about 90 V, it is possible that the regulator IC (7506) is defective. |
| No RC-reception. Red LED does not echo RC-commands. | µP circuitry or RC-receiver is defective. | In case the set does react on a local keyboard operation, you must check the RC-receiver circuitry (diagram E). |
| Relay (degaussing) is not audible, when set is switched from 'off' or 'standby' to 'on'. | µP is not working correctly. When pin 115 is low, the degaussing must be activated. | Check RESET-circuitry on diagram B5. Check the level on pin 115 when you switch the set 'on'. Signal must be low initially and go to high after approx. 12 s. |
| No sound, only picture. | Measure A7/A8 on diagram A1. Possibly the audio amplifier is defect (but not shorted), or the 'sound enable' line is high (diagram A5). Further, measure the audio signal path (HIP-MSP-Switch ICs-Amplifier). | In ComPair, a beep test can determine where the signal stops (use loudspeakers or headphone).<br>Possible cause is also the 'PROT1' protection (see diagram. A6). This is a loudspeaker DC protection, which the µP can not sense. Via circuitry 7701/7707, this signal can put audio amplifiers 7700 and 7702 in standby mode (tri-state input). Warning: Find out, which amplifier is causing the problem, because it is possible, that the other one is OK. |
| No sound at headphone output. | HP amplifier (7770), or the supply to it, malfunctions. | Measure test points A64 to A67, and the supply line (+/- 16/19V) on diagram A7. |
| Picture is rotated. | Rotation circuitry, or related supply to it, malfunctions. | Measure test points A52 and A53 on diagram A5. |
| Picture is continuously switching 'off' and 'on', showing heavy 'switch' spots (set does not go into protection). | 200 V is missing on CRT panel. | Probably a bad connection from LSP connector 1424 to CRT connector 1224 (diagram F), or an interruption of the 200 V supply line (e.g. R3341 is interrupted). |
| Picture is not sharp. | Focus is possibly mis-aligned or SCAVEM-circuitry does not work correctly. | Re-align the 'focus' potmeter on the Line Output Transformer, or check the SCAVEM circuitry on the CRT-panel (diagram F). It is also possible that the DAF circuitry is defective (see diagram I). Check the Vdc values. |
| Picture is not synchronised. | The sync is derived in the HIP from xtal 1305 and/or 1308. | Maybe the crystals 1305 and/or 1308 are making a bad contact. |
| Picture is distorted. | Check video-path in Service Default Mode. | Investigate whether there is an error code present in the error buffer. In case there is one, check the $I^2C$-bus and/or supply lines (see overview supply lines).<br>Measure and check signal path Tuner-HIP-PICNIC-HOP-RGB amplifier.<br>In case it is a geometry issue, check opto-coupler 7482, OpAmps 7440/7450 and the Frame circuitry alignments or a possible corrupted NVM (7011). |
| Picture with horizontal stripes. | Feature box processing is malfunctioning | Check functionality of PICNIC (7709), FALCONIC (7726) and/or field memories (7714 and 7740). TS7726 and 7740 are suspected. |
| No menu, no OSD. | Probably a defective µP. | Measure test points B61to B64 on diagram B5. |
| No NextView (EPG). | IC7012 defective or not powered. | Check circuitry around IC7012. |
| No Teletext. | IC7007 defective or not powered. | Check circuitry around IC7007. Check also B61to B64 around µP on diagram B5. |
| Strange switch 'off' behaviour | TS7445 possibly defective. | Check, with a multimeter, whether transistor TS7445 is well functioning. |
| Various symptoms, due to missing local supply voltage. | An interrupted fuse, NFR-resistor or connection. | When no symptom or error code leads you to a specific circuitry, use the supply lines overview (see chapter 6), for a quick scan of all supply lines. |

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***Personal Notes:***

# 8. Electrical Alignments

Index of this chapter:


**Note:** The Service Default Mode (SDM) and Service Alignment Mode (SAM) are described in chapter 5. Menu navigation is done with the 'CURSOR UP, DOWN, LEFT or RIGHT' keys of the remote control transmitter.

## 8.1 General Alignment Conditions

Perform all electrical adjustments under the following conditions:
- Power supply voltage: 230 $V_{AC}$ / 50 Hz (± 10 %).
- Connect the set to the mains via an isolation transformer with low internal resistance.
- Allow the set to warm up for approximately 20 minutes.
- Measure the voltages and waveforms in relation to chassis ground (with the exception of the voltages on the primary side of the power supply).
  **Caution**: never use the cooling fins / plates as ground.
- Test probe: Ri > 10 MΩ, Ci < 20 pF.
- Use an isolated trimmer/screwdriver to perform the alignments.

## 8.2 Hardware Alignments

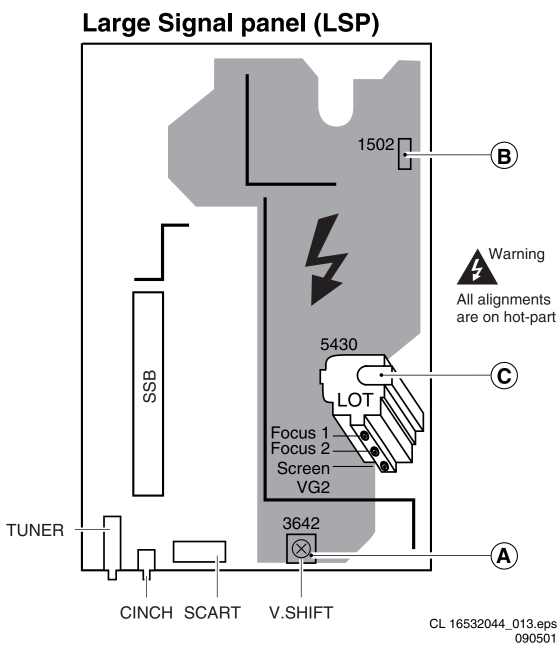



Figure 8-1

### 8.2.1 Vg2 Adjustment

**Method 1** (without oscilloscope)
1. Activate the SAM.
2. Select ‘Alignments’.
3. Select the ‘General’ sub-menu.
4. Set ‘Vg2 Test Pattern’ to ‘On’
5. First turn the Vg2 potmeter on the LOT (see Fig. 8-1) to the left (OSD feedback will show ‘Out high’).
6. Turn the Vg2 potmeter slowly clockwise until you read ‘In low’. This is the correct value.

**Method 2** (with oscilloscope)
In the frame-blanking period of the R, G and B signals applied to the CRT, the ‘HOP’ video processor inserts a measuring pulse with different DC levels. Measure the black level pulse during the vertical flyback at the RGB cathodes of the CRT.
1. Go, via the MENU key, to the normal user menu, select PICTURE, and set CONTRAST and BRIGHTNESS to 0.
2. Activate the SAM.
3. Connect the RF output of a pattern generator to the antenna input. Test pattern is a 'black' picture (blank screen on CRT without any OSD info).
4. Set the channel of the oscilloscope to 50 V/div and the time base to 0.2 ms. Use external triggering on the vertical pulse (**caution:** use e.g. R3641 **,which is at the ‘cold’ side!**).
5. Ground the scope at the CRT panel (‘cold’ side) and connect a 10:1 probe to one of the cathodes of the picture tube socket (see diagram F).
6. Measure the cut off pulse during first full line after the frame blanking (see Fig. 8-2). You will see two pulses, one being the cut-off pulse and the other being the white drive pulse. Choose the one with the lowest value, this is the cut-off pulse.
7. Select the cathode with the highest $V_{DC}$ value for the alignment. Adjust the $V_{cutoff}$ of this gun with the SCREEN potentiometer on the LOT (see Fig. 8-1) to the correct value (160 ± 3 $V_{DC}$).
8. Restore CONTRAST and BRIGHTNESS to normal (CONTRAST= 63 and BRIGHTNESS= 34).

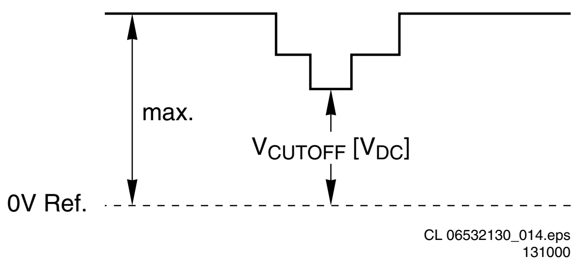



Figure 8-2

### 8.2.2 Focusing

1. Tune the set to a circle & crosshatch test pattern (use an external video pattern generator).
2. Choose picture mode ‘NATURAL’ with the ‘SMART PICTURE’ button on the remote control transmitter.
3. Adjust the FOCUS 1 potentiometer (upper potmeter, see Fig. 8-1) until the horizontal and vertical lines at 1/4 from east and west, at the height of the centre line, are of minimum width without visible haze.
4. Adjust the FOCUS 2 potentiometer (middle potmeter, see Fig. 8-1) until the horizontal and vertical lines at 1/4 from north and south, at the height of the centre line, are of minimum width without visible haze.

## 8.3 Software Alignments

### 8.3.1 Introduction

With the software alignments, it is possible to align the Geometry, White Tone and Tuner IF settings.
Put the set in the SAM (see chapter 5.2.2). The SAM menu will now appear on the screen. Select, via 'Alignments', one of the following submenus:

```
Alignments

General                  >
Normal Geometry          >
Super Wide Geometry      >
Options                  >
Option Numbers           >
Store                    >
```

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**Figure 8-3**

- **General**: Select this sub-menu to perform general software alignments.
- **Normal Geometry**: Select this sub-menu to perform standard geometry alignments.
- **Super Wide Geometry**: Select this sub-menu to perform geometry alignments for the 'Panorama' position in 16:9 sets (only valid for wide screen sets). Alignments can be performed; however, it is better to set values as mentioned below.
- **Options**: Select this sub-menu to set the initialisation codes of the set via text menu's.
- **Option Numbers**: Select this sub-menu to set all options at once (expressed in two long numbers). The original factory settings are printed on a sticker that is placed on the CRT (inside the set).
- **Store**: Select this sub-menu to store the performed alignments.

The alignments are explained below in the sequence of the sub-menu.

**Note**:
- Once all alignments/settings have been completed the item '**Store**' must be selected to record all the values in the permanent memory of the set.
- If the Option codes have been changed and stored, the set has to be switched 'OFF' and 'ON' using the mains switch to activate the new settings (when switching via Standby, the option code settings are NOT read by the microprocessor).
- If an empty EAROM (permanent memory) is detected, all settings are set to pre-programmed default values.
- A built-in test pattern can be called up in various sub-menus. The test pattern generator can be switched on using the item 'Test pattern on/off'. The test pattern only appears AFTER the specific alignment has been selected. The test patterns are generated by the Teletext-IC (OTC).

### 8.3.2 'General' alignments

***Drive***

**Method 1** (with colour analyser):
1. Select 'Test pattern' and turn it 'On'. You will get a white block in middle of the image now.
2. Select 'Cathode' and adjust the set to the correct light output. This setting depends on the picture tube size and brand. See table 'Cathode parameter' for the colour analyser readings.
3. Select 'Tint' and set it to one of the three colour temperatures ('Cool', 'Normal' or 'Warm')
4. Set the white levels according to the values in the table 'White levels'.

| Cathode parameter | |
|---|---|
| CRT | Light output (cd/m²) |
| 28" RF WS | 400 |
| 32" RF WS | 350 |

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**Figure 8-4**

| White levels | | | |
|---|---|---|---|
| | Cool | Normal | Warm |
| X | 280 | 289 | 313 |
| Y | 287 | 299 | 329 |
| Temp. (K) | 10200 | 8700 | 6500 |

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**Figure 8-5**

**Method 2** (without colour analyser):
1. Without having a colour-analyser one can set some parameters. This is the next best solution. The setting-parameters are average values coming from production (statistics).
2. Select 'Cathode' and enter the value '15' (for all picture tubes).
3. Select 'Tint' and set it to one of the three colour temperatures ('Cool', 'Normal' or 'Warm').
4. Set the 'Red', 'Green' and 'Blue' parameters according to the values in table 'Tint settings'.
5. 'Red BL offset': herewith the Black Level can be aligned very precise. Default value is 7.
6. 'Green BL offset': herewith the Black Level can be aligned very precise. Default value is 6.

| Tint settings | | | |
|---|---|---|---|
| | δ Cool | Normal | δ Warm |
| **R** | -1 | 37 | + 4 |
| **G** | 0 | 30 | 0 |
| **B** | + 4 | 31 | - 8 |

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**Figure 8-6**

***Luminance delays***
With this alignment you place the luminance information exactly on the chrominance information (brightness is pushed onto the colour). Use a colour bar/grey scale pattern as test signal.
- **Lum. Delay Pal**: Apply a PAL colour bar/grey scale pattern as a test signal. Adjust this parameter until the transients of the colour part and black and white part of the test pattern are at the same position.
- **Lum. Delay Secam**: Apply a SECAM colour bar/grey scale pattern as a test signal. Adjust this parameter until the transients of the colour part and black and white part of the test pattern are at the same position.
- **Lum. Delay Bypass**: apply a NTSC colour bar/greyscale pattern as a test signal. Adjust this value until the transients of the colour and black & white part of the test area are at the same position.

***EHT compensation***
Fixed setting: 5

***Soft clipper***
Fixed setting:Pwl + 0%

***Luma gain***
Fixed setting:1

***IF AFC***
Supply, via an external video generator (e.g. PM5518), a TV signal with a signal strength of at least 1 mV and a frequency of 475.25 MHz. Use system BG if possible, otherwise match the system of your generator with the received signal in the set.

Alignment procedure:
1. Go to the 'Installation' menu.
2. Select 'Manual installation'.
3. Tune the TV-set to the system and frequency described above via 'Search' - '475' - 'OK'.
4. If the frequency, showed in the line 'Fine tune', is between 475.18 MHz and 475.31 MHz, you don't need to re-adjust the 'IF AFC'.
5. If not, adjust the frequency in the 'Fine tune' line to 475.25 MHz and 'Store' the program (this is **very important** because this will disable the AFC algorithm).
6. Now go to the SAM and select 'Alignments' - 'General' - 'IF AFC'.
7. During the 'IF AFC'-parameter adjustment, one can see OSD feedback in the top of the screen. This OSD feedback can give 4 kind of messages:

| AFC-window | AFC-frequency vs. reference |
|---|---|
| Out | High |
| In | High |
| In | Low |
| Out | Low |

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**Figure 8-7**

The first item ('In' or 'Out') informs you whether you are in or out the AFC-window.
The second item ('High' or 'Low') informs you about whether the AFC-frequency is too high or too low.
1. First you must align the 'IF AFC'-parameter such that you come into the AFC-window (= 'In')
2. Then you must look for the point where the 'IF AFC'-parameter changes from 'High' to 'Low'. This level is the value you are looking for.
3. After adjustment, 'Store' the value.
4. Now return to the 'Installation' menu.
5. Select 'Manual Installation' - 'Search' - '475' - 'OK' and 'Store'. This will set the AFC 'on' again.

**Service tip:** If you do not trust the frequency accuracy of your service generator, connect it to a 'good' TV set and check it with the 'Fine tune'-line.

***Tuner AGC***
1. Set the external pattern generator to a colour bar video signal and connect the RF output to the aerial input. Set the amplitude to 10 mV and set the frequency to 475.25 MHz.
2. Connect a DC multimeter between pin 1 and the shielding of the Tuner (item 1200 on the LSP).
3. Adjust the 'TUNER AGC' value (default value is 25) with the LEFT/RIGHT cursor keys until the voltage at pin 1 of the tuner lies between 3.8 and 2.3 V.
4. 'Store' the alignment.

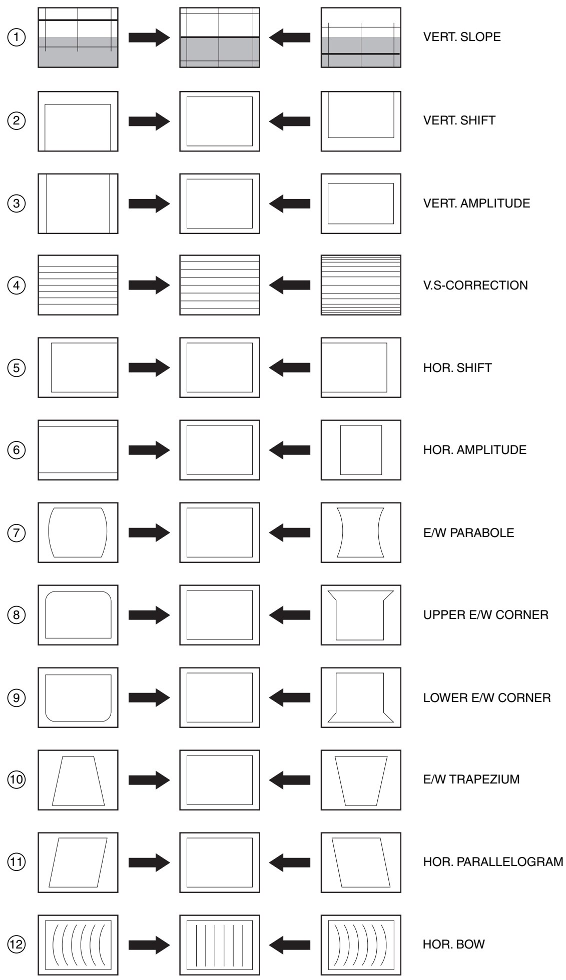
***Blend intensity***
Use this alignment when you replace the microcontroller or the HOP. It aligns the level of transparency of the menu-picture blended into the main-picture.
1. Position the BRIGHTNESS, CONTRAST and COLOUR setting in the middle position (picture-menu).
2. Apply a signal with a 100 % white video-pattern.
3. Connect an oscilloscope to pin 8 of connector 1298 of the CRT panel and measure the Red output level.
4. Align the 'Blend intensity' parameter such, that the blended signal is 65 % of the black-white amplitude. In practice this is about 1.3 V (blended signal) versus 2 V (full white signal).
5. The parameter can be adjusted in between 0 and 31.

***Adjust Peak White Limiter***
Enter value '4' for all picture tubes.

***Vg2 Test Pattern***
In this sub-menu, you can turn 'On' the OSD feedback for the Vg2 alignment (see chapter 8.2.1).

### 8.3.3 'Normal Geometry' alignments

***Introduction***
Use for all geometry alignments, an external pattern generator with a geometry pattern (e.g. crosshatch).
See figure below for the correct alignments.




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**Figure 8-8**

**Warning:** The use of the 'Internal Test Pattern' will, at this moment, lead to a mis-alignment of the picture geometry. So use an external generator with a geometry pattern (e.g.

crosshatch) for a correct geometry alignment. Use the 'Internal Test Pattern' only for the 'Vertical slope' alignment.

***V. slope***

This alignment is meant to align the zero crossing of the frame deflection to the mechanical middle of the picture tube.

1. Set 'Test Pattern' to ‘On' (read warning above).
2. Set the 'V. S-correction' value to ‘0’ all sets (the boundary-stripes of the test pattern should be positioned on the edge of the picture tube).
3. Align ‘V. slope’ (when aligning, the lower half of the picture is blanked) such, that the middle line of the test pattern is matched with the edge of the pattern transient in the middle of the picture.
4. Push the 'MENU' button to return to the previous menu.

***Vertical alignment***

1. Use 'V. amplitude' to align the vertical amplitude so that the entire test pattern is visible.
2. Set 'V. shift' to value ‘32’.
3. Connect a voltmeter ($V_{DC}$) between R3624 and ‘hot’ ground.
4. Adjust the DC voltage to ‘0’ with potmeter R3642.
5. Use 'V. shift' again to align the test pattern vertically in the middle.
6. Repeat the the alignment if necessary.

***Horizontal alignment***

1. Use 'H. amplitude' to align the horizontal amplitude so that the entire test pattern is visible.
2. Use 'H. shift' to align the picture horizontally in the middle.
3. Repeat the 'H. amplitude' alignment if necessary.

**Note:** In case the horizontal linearity in wide-screen mode is out of tolerance, add a ‘DC-shift correction’ panel (3104 328 06230) to connector 1419 of the DAF-panel [ I ]. Be sure to switch ‘off’ the set first.
On the DC-shift panel, cut diode 6433 for correction to the right or diode 6432 for correction to the left.
**Caution:** never plug in a *not pre-aligned* module in a set !!!

***East/west alignment***

1. Use 'East/West Parabola' to align the vertical lines until straight.
2. Use 'Upper East/West corner' to align the vertical lines in the upper corners until straight.
3. Use 'Lower East/West corner' to align the vertical lines in the lower corners until straight.
4. Use ‘East/West Trapezium’ to align for a rectangular.
5. Use 'Horizontal Parallelogram’ to align for straight vertical lines if necessary.
6. Use ‘Horizontal Bow' to correct the E/W parabola such, that it becomes symmetrical. Default value is ‘31’.
7. Repeat steps 1 to 6 if necessary.

### 8.3.4 'Super wide geometry' alignments (only for widescreen sets)

**Note:** The header of this paragraph and also the menu’s are somewhat misleading. We only need to set the following values (if the normal geometry alignment has been performed correctly):

1. For ‘V. shift’ use the default value 33.
2. For ‘V. amplitude’ use the default value 25.
3. ‘V. S-Correction’, enter value of 'normal geometry' alignment.
4. ‘H. amplitude’, enter value of 'normal geometry' alignment subtracted by 1.
5. ‘East/west Parabola’, enter value of 'normal geometry' alignment.

## 8.4 Option Settings

### 8.4.1 Introduction

The microprocessor communicates with a large number of $I^2C$ ICs in the set. To ensure good communication and to make digital diagnosis possible, the microprocessor has to know which ICs to address. The presence / absence of these specific ICs (or functions) is made known via the option codes.

You can set the ‘hardware related’ options via the SAM - ‘Alignments’ - ‘Options’ or ‘Option Numbers’ menu.
You can set the ‘software related’ options via the SAM - ‘Dealer Options’ menu .

After you have changed the option(s), save them via the 'Store' command.

The new option setting is only active after the TV is switched OFF and ON again via the mains switch (the EAROM is then read out again).

### 8.4.2 Options

Select this sub-menu to set the initialisation codes (= options) of the set via text menu's.

| Menu-item | Subjects | Options | Physically in the set |
|---|---|---|---|
| Dual screen/PIP | Aux type | None | Feauture not present. |
| | Text Dual Screen | Yes | Text Dual Screen present |
| | | No | Text Dual Screen not present |
| Teletext/EPG | TXT | Yes | Teletext present |
| | | No | Teletext not present |
| | NextView present | Yes | NextView set |
| | | No | NextView not set |
| | NextView type | Flashram | Flash-RAM present |
| | | No Flashram | Flash-RAM present |
| Communication | Easylink Plus | Yes | Easylink Plus set |
| | | No | Easylink Plus not set |
| Picture Tube | CRT Type | 4:3 | 4:3 picture tube |
| | | 16:9 | 16:9 picture tube |
| | Picture Rotation | Yes | Frame rotation circuitry present (diagram A5) |
| | | No | Frame rotation circuitry not present |
| | Dynamic focus | Yes | Dynamic focus (DAF) present (diagram I) |
| | | No | Dynamic focus (DAF) not present |
| | One Point Control | Yes | |
| | | No | |
| Video repro | Featurebox type | Eco | PROZONIC not present |
| | | Prozonic | PROZONIC present |
| | | Falconic | FALCONIC present |
| | | 1050i/1250i | Progressive scan mode |
| | Field memories | 2 | |
| | | 3 | |
| | Lightsensor | Yes | Lightsensor present |
| | | No | Lightsensor not present |
| | PALplus | Yes | PALplus module present |
| | | No | PALplus module not present |
| | Combfilter | Yes | Not valid for Europe |
| | | No | |
| | Picture improvement | Yes | LTP present |
| | | No | LTP not present |
| | Picnic | Yes | PICNIC present |
| | | No | PICNIC not present |
| | Picnic AGC | Yes | In normal operation: Yes |
| | | No | During 'Drive' alignments: No |
| | Signalling bits | Yes | |
| | | No | |
| Source Selection | External 3 | Yes | 3rd EURO connector present (diagram H) |
| | | No | No 3rd EURO connector present |
| | External 4 | Yes | 4th EURO connector present |
| | | No | No 4th EURO connector present |
| Audio Repro | Dolby | None | |
| | | Pro Logic | |
| | Rear speakers | Corded | Passive surroundbox present |
| | | Virtual | Virtual Dolby (without rear speakers) |
| | | Cordless | Active surroundbox present |
| | Acoustic system | FL9 Monitor | Modern design with only tweeters at both sides (monitor look) |
| | | FL9 DAS | Modern design with full range speakers at both sides |
| | | FL12 | Soft design with full range speakers at both sides |
| | Virtual Dolby | Yes | |
| | | No | |
| | AVL | On | Automatic Volume Limiter on |
| | | Off | Automatic Volume Limiter off |
| Miscellaneous | Heatsink Present | Yes | Heatsink present on CRT/SCAVEM panel (diagram F) |
| | | No | Heatsink not present on CRT/SCAVEM panel (diagram F) |
| | Tuner type | UV1316 | |
| | | TEDE9 | |

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**Figure 8-9**

### 8.4.3 Option numbers

Select this sub-menu to set all options at once (expressed in two long numbers).

An option number (or 'option byte') represents a number of different options. When you change these numbers directly, you can set all options very fast. All options are controlled via eight option numbers.

When the EAROM is replaced, all options will require a re-setting. To be certain that the factory settings are reproduced exactly, you must set **both** option number lines. You can find the correct option numbers on a CRT sticker inside the TV set.

Example: The CRT sticker in the 32PW8870 gives the following option numbers:
**04866 04384 08001 00016**
**12407 00001 00000 00071**
The first line indicates the hardware options 1 to 4, the second line is reserved for the software options.
Every 5-digit number represents 16 bits (so maximum number can be 65536 if all options are set).

When all the correct options are set, the sum of the decimal values of each Option Byte (OB) will give the option number.

| OB | Bit | Option name | Settings (given in decimal values) | | Option number |
|---|---|---|---|---|---|
| 0 | 0<br>1<br>2<br>3 | Cabinet | 0 = FL6 (n/a)<br>2 = FL8 (n/a)<br>4 = FL9 Monitor<br>6 = FL11 (n/a) | 1= FL7 (n/a)<br>3 = FL9 DAS<br>5 = FL10 (n/a)<br>7 = FL12 | Sum OB0 |
| | | | | | |
| | 6 | AVL | 0 = Off | 64 = On | |
| 1 | | | | | Sum OB1 |
| 2 | 0 | CTI | 0 = Off | 1 = On | Sum OB2 |
| 3 | 0 | Auto TV | 0 = Off | 1 = On | Sum OB3 |
| | 1<br>2 | Auto Store Mode | 0 = None<br>4 = TXT Page | 2 = PDC/VPS<br>6 = PDC/VPS/TXT Page | |
| | 3 | | | | |
| | 4 | Picture Mute | 0 = Off | 16 = On | |
| | 5 | Demo | 0 = Off | 32 = On | |
| | 6 | Virgin | 0 = Off | 64 = On | |
| | | | | | |
| | 12 | TXT Preference | 0 = TOP | 4096 = FLOF | |
| | 13 | TXT Region | 0 = East | 8192 = West | |
| 4 | 0 | | | | Sum OB4 |
| | 2 | China IF | 0 = Off | 4 = On | |
| | 3 | Tuner | 0 = Philips | 8 = Alps | |
| | 4 | TXT | 0 = Off | 16 = On | |
| | 5 | China TXT | 0 = Off | 32 = On | |
| 5 | 0 | EXT3 | 0 = Off | 1 = On | Sum OB5 |
| | 1 | EXT4 | 0 = Off | 2 = On | |
| | | | | | |
| | 4<br>5 | Dual Screen | 0 = None<br>32 = Dual Screen | 16 = PIP | |
| | 6 | TXT/EPG/DS | 0 = Off | 64 = On | |
| | 7 | Aux. Headph. Sound | 0 = Off | 128 = On | |
| | 8 | Aspect Ratio | 0 = 4:3 | 1 = 16:9 | |
| | 9 | Tilt | 0 = Off | 512 = On | |
| | 10 | DAF | 0 = Off | 1024 = On | |
| | 11 | One Point Control | 0 = Off | 2048 = On | |
| | 12 | Heat Sink | 0 = Off | 4096 = On | |
| | 13 | | | | |
| | 14 | Home Cinema | 0 = Off | 16384 = On | |
| 6 | 0 | | | | Sum OB6 |
| | 1 | Dolby ProLogic | 0 = Off | 2 = On | |
| | 2 | Virtual Rear Spkrs | 0 = Off | 4 = On | |
| | 3 | Cordless Rear Spkrs | 0 = Off | 8 = On | |
| | 4 | Dolby Digital | 0 = Off | 16 = On | |
| | 5 | Virtual Dolby | 0 = Off | 32 = On | |
| | | | | | |
| | 8 | P50 Easylink | 0 = Off | 256 = On | |
| | | | | | |
| | 12 | EPG | 0 = Off | 4096 = On | |
| | 13 | EPG Type | 0 = Type 2 | 8192 = Type 2C3 | |
| 7 | 0<br>1<br>2 | Featurebox | 0 = Eco<br>2 = Melzonic (n/a) | 1 = Prozonic<br>3 = Falconic | Sum OB7 |
| | 3 | Comb Filter | 0 = Off | 8 = On | |
| | 4 | PALplus | 0 = Off | 16 = On | |
| | 5 | Field Memories | 0 = 2 memories | 32 = 3 memories | |
| | 6 | Light Sensor | 0 = Off | 64 = On | |
| | 7 | Luma Trans. Proc. | 0 = Off | 128 = On | |
| | 8 | PICNIC | 0 = Off | 256 = On | |
| | 9 | PICNIC-AGC | 0 = Off | 512 = On | |
| | 10 | | | | |
| | 11 | LNA | 0 = Off | 2048 = On | |
| | 12 | WSS | 0 = Off | 4096 = On | |
| | 13 | Time Constant | 0 = Normal | 8192 = Fast | |

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**Figure 8-10**

### 8.4.4 Dealer Options

| Menu name | Subjects | Options | Physically in set |
|---|---|---|---|
| Picture | CTI | Yes | CTI enabled |
| | | No | CTI disabled |
| Personal | Blue Mute | Yes | Blue mute activein case no picture detected |
| | | No | Noise in case of no picture detected |
| | Virgin Mode | Yes | TV starts up once with language selection menu after mains switch on for the first time (virgin mode) |
| | | No | TV does not starts up once with language selection menu after mains switch on for the first time (virgin mode) |
| | Auto Store Mode | None | Autostore mode disabled (not in installation menu) |
| | | PDC-VPS | Autostore mode via ATS (PDC/VPS) enabled |
| | | TXT page | Autostore mode via ACI enabled |
| | | PDC-VPS-TXT | Autostore mode via ACI or ATS enabled |
| | Demo Menu Enable | Yes | Demo menu enable |
| | | No | Demo menu disable |
| | Auto TV | Yes | Auto TV mode enabled |
| | | No | Auto TV mode disabled |
| Teletext | TXT Preference | TOP | Preference to TOP Teletext |
| | | FLOF | Preference to FLOF Teletext |
| | East/West TXT | West | TXT characters for non -/58 sets |
| | | East | TXT characters for -/58 sets |

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# 9. Circuit Descriptions and Abbreviation List

Index of this chapter



## 9.1 Introduction

The EM3 Europe is a higher specified chassis as the EM2 Europe. EM stands for Eco-MG, 3 for an indication that this set is higher specified as the EM2E. So EM2E is a known chassis with Digital Scan, EM3E is set with Natural Motion, EM4E will be the EM3E set inclusive a Digital Reception board. -

Differences between the EM3E versus EM2E:

- the start-up method is much more simple (no POR-bit anymore)
- the set has an advanced Standby Power Supply, including MOSFET-switches for making Semi-standby (needed for Easylink and digital reception in future)
- added features as Natural Motion, EPG, LTP and upgraded Auto-TV
- the sound amplifiers have symmetrical supply voltages now. The IC is changed from TDA2616 to TDA7490 (class-D amplifier, needing very little cooling)
- the vertical amplitude hardware alignment is changed to a software alignment via the SAM menu
- the vertical shift alignment is split into a hardware ***and*** a software alignment (needed due to spread)
- the Frame drive signals from the HOP are symmetrical.

The architecture consist of a conventional large signal panel (LSP) and a small signal board (SSB) module, placed into a so called SIMM-connector (Standard Interface, 80 pins).

The LSP is built up very conventional, with hardly any surface mounted components on the copper side. Similar with the EM2E (but different as with the MG-chassis), the EM3E LSP has a very large 'hot' part, including both deflection coils.

The SSB is a high tech module (2 sides reflow technology, full SMC) with very high component density and complete shielding for EMC-reasons. Despite this, it is designed in such a way, that repair on component level still is possible. To achieve this, attention was paid to:

- The position of service test lands: most of them are at the Tuner side.
- Accessibility (Tuner side). If there are still problems with the accessibility, one can order an extension board (see parts list).
- Clearance around surface mounted ICs (for replacing).
- Detailed diagnostics and fault finding is possible via ComPair.

**Attention:** During the first 4 to 6 months of production, the EM3E set-software will be integrated into a Flash-RAM on the SSB. After that period, a Mask-ROM will be used. Which IC is used is not of interest for Service, however for both solutions it means that Service Workshops must be equipped with dedicated (de) solder equipment for exchanging these ICs.

In case one must replace a Flash-RAM or a Mask-ROM in the field, the Dealer will receive always an up-to-date Flash-RAM.

**Warning:** Be aware that half of the LSP-circuitry is 'hot', including the deflection coils.

## 9.2 Block Diagram

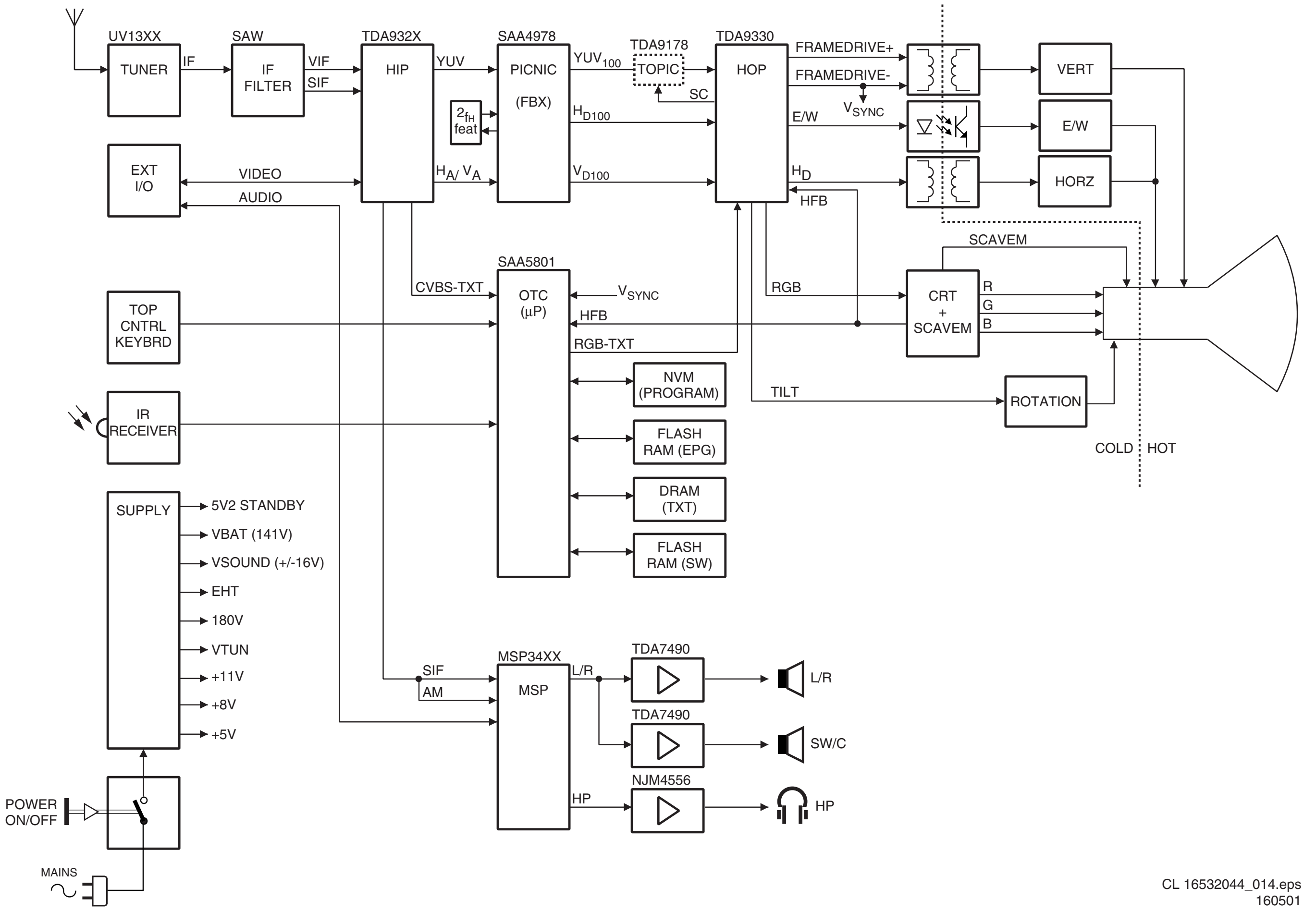



**Figure 9-1**

The Tuner (item 1200) is a PLL tuner and delivers the IF-signal, via audio & video SAW-filters, to the HIP (High-end Input Processor). The HIP has the following functions:

- IF modulation.
- Video source- and record select.
- Colour decoder.
- Synchronisation.

Three SCART-connectors can be used:

– SCART1 is fully equipped,
– SCART2 is meant for VCR. Pin 10 is used for Easylink and there is a possibility for Y/C in. The CVBS-out on pin 19 is meant for WYSIWYR (What You See Is What You Record).
– SCART3 is a CVBS and audio L/R input.

The HIP delivers YUV and sync signals to the PICNIC. This IC takes care of:

- Analogue to Digital conversion and vice versa.
- 50 to 100 Hz conversion.
- Panorama mode.
- Noise reduction.
- Dynamic contrast.

The '2fH features'-block in the diagram gives several options:

– for Digital Scan the PROZONIC is required
– for Natural Motion the FALCONIC is required.

After the PICNIC the, now 100 Hz, YUV- and H/V-signals are fed to the HOP (High-end Output Processor). This IC handles the video control and geometry part. The RGB-signals for TXT/OSD (from the µP) are also inserted via the HOP. The video part delivers the RGB signals to the CRT-panel and the geometry part delivers the H-drive, V-drive and also a drive-signal for rotation.

Both deflection circuits are 'hot' and located on the LSP. They are driven by the HOP. To make a galvanic separation, the Line Drive is driven via transformer 5410 and the Frame Drive via transformer 5621.The horizontal output stage generates some supply voltages and the EHT-, focus- and Vg2-voltages.

The RGB amplifiers on the CRT-panel are integrated in one IC and are supplied with 200 V from the LOT.
The SCAVEM circuit modulates transitions of the Luminance (Y) signal on the horizontal deflection current, giving a sharper picture.

The sound part is built around the MSP34xx (Multi-channel Sound Processor) for IF sound detection, sound control and source selection. Dolby decoding is also done by the MSP. Amplification is done via a 'class D' integrated power amplifier IC, the TDA7490.

The microprocessor, called OTC (OSD, Teletext and Control) takes care of the analogue TXT input- and output processing. The OTC, ROM and RAM are supplied with 3.3 V, which is derived from the +5V2STANDBY.
The NVM (Non Volatile Memory) is used to store the settings, one Flash-RAM contains the set software, the other Flash-RAM (7012) is for EPG and the DRAM is used for storing the Teletext pages.

In EM3E there is a separate Standby Supply, in order to reduce the Standby power consumption. During Standby, the

Main Supply is switched ‘off’ (via TS7529). A relay (1550) is used to switch the Degaussing circuit. It is switched ‘on’ after set start-up and switched ‘off’ by the µP after 12 s.
The Main Supply, an SMPS that is based on the 'down-converter' principle, generates the 141 V ($V_{BAT}$) and the +/- 16 V for the audio part. Difference with former MG-sets is that $V_{BAT}$ is **not** mains isolated ('hot') and is alignment free.

## 9.3 Power Supply (diagram A1 & A2)

The power supply has a number of main functions:

- Mains harmonic filter.
- Degaussing picture tube.
- Standby power supply.
- Main supply.

### 9.3.1 Mains Harmonic Filter (diagram A1)

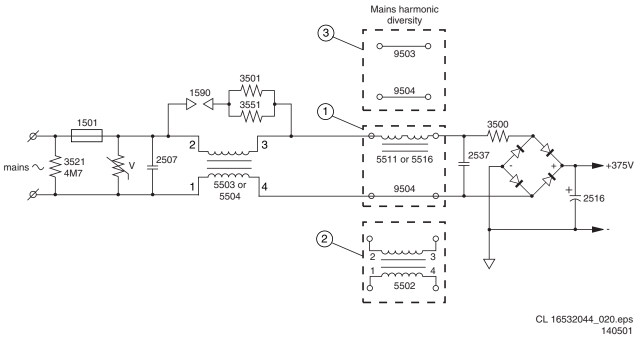



Figure 9-2

The mains harmonic filter has 2 functions: to prevent that high frequency signals (harmonics) are transferred into the mains and to protect the set from lightning damage.

C2507 prevents that the high frequency signals, generated by the set, are conveyed into the mains (it forms a short-circuit).

In case of a lightning surge between the 2 phases (differential mode) the energy is immediately bled away through the VDR (R3509) to the other phase.
In case of a lightning surge on both phases of the mains in relation to the aerial earth, the filter acts as a high resistance ($U_{EMK}$=L * dI/dt), as a result of which the voltage across coil L5503/04 increases. A spark gap (1590) prevents that the voltage increases too much, which would lead to a damaged coil. When ignited, the current will be discharged via this spark gap.
Resistor R3500 is used for limiting the inrush-current.

### 9.3.2 Degaussing (diagram A1)

The 5V2 is present, as soon the set is switched 'on' via the mains switch. As the ‘DEGAUSSING’ signal from the processor (OTC) is ‘low’, transistor 7528 will conduct and relay 1550 is activated. Initially a considerable current will flow, via PTC 3516, through the degaussing coil. The PTC will heat up, resistance will rise and the current will decay rapidly. The OTC makes the ‘DEGAUSSING’ signal ‘high’ after 12 s, which will switch the relay ‘off’.

### 9.3.3 Standby power supply (diagram A2)

***Principle***

This power supply is of a SOPS type (Self-Oscillating Power Supply) and is regulated by the controlled switching of an oscillator. It uses the so-called 'Flyback' principle:

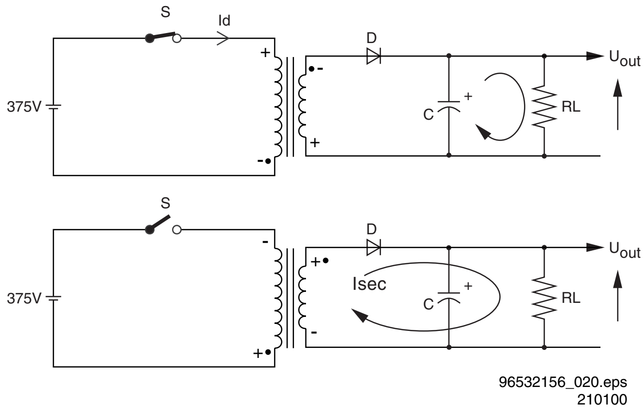



Figure 9-3

- After closing switch 'S', the current ID will increase linear in time. The magnetic energy in the primary coil is directly proportional with the self-inductance of the coil and current ID (thus with the time the switch is closed). The voltage polarity at the secondary winding is negative (due to different winding direction), meaning that diode D will block. Capacitor C will discharge via RL, $U_{OUT}$ will decrease.
- Opening switch 'S' will generate a counter-e.m.f. in the primary winding, trying to maintain current ID. Through this the polarity of the secondary voltage will inverse. The magnetic energy, stored in the coil, will now be transformed to the secondary side. Diode D will now conduct, capacitor C will be charged and $_{OUT}$ will increase.

***Implementation***

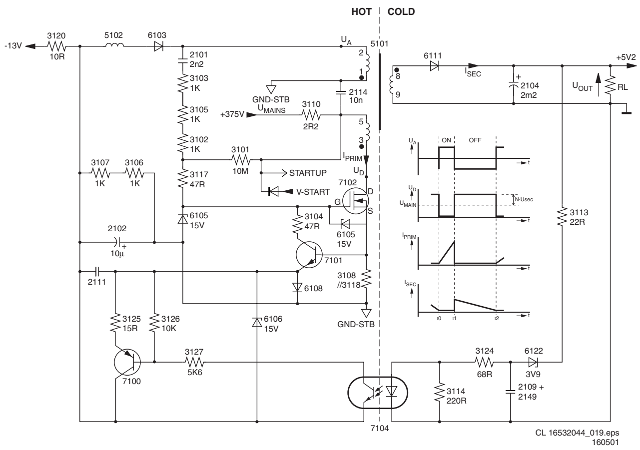



Figure 9-4

To apply this on the EM3E (diagram A2): replace switch 'S' by FET TS7102, coil L by L5101/L5100, diode D by D6111 and C by C2104.

– **Time interval t0 - t1:** After switching ‘on’ the TV-set, the gate of MOSFET TS7102 will be high (max. 15 V due to zener diode D6105). This will drive the FET into saturation ($U_{DS}$ = 0 V). The DC-voltage $U_{MAINS}$ will be transposed across the primary winding of L5101 (3, 5), resulting in a linear increasing current through this coil. The voltage across the co-coupled coil (1, 2) is also positive and will keep the FET into conductivity via C2101, R3103/3105/3102 and R3117 for some time. The self-induction of the coil and the magnitude of the supply voltage (+375 V) determine the slope of the primary current. The maximum current is determined by the time the FET stays into conductance (t0 - t1). This time is directly determined by the voltage across R3108/

/R3118 (= 5 Ω). This voltage is a measure of the current and if it exceeds 1.4 V, TS7101 will be driven into conductivity and consequently connects the gate of TS7102 to earth. The FET will block. The current is: 1.4 V / 5 Ω = 0.28 A. The voltage across the secondary winding (8,9) will be negative, diodes D6111 and D6107 will block.

– **Time interval t1 - t2:** The sudden current interruption in the primary coil will induce a counter-e.m.f. that wants to maintain the current. The voltage on the drain of the FET will increase. The secondary voltage (8, 9) will become positive and will charge C2104 via D6111. All energy that was stored in L5101 during t0 - t1 will be transferred into the load. Due to the transformer principle, a voltage will now be induced in the primary winding (3, 5) and the co-coupled winding (1, 2). This voltage will be N* $U_{SEC}$ (N= winding ratio). The voltage across the co-coupled coil will be negative, keeping the FET blocked.
– **Time t2:** At t2, the current through the secondary coil will be reduced to zero, as C2104 is no longer charged. As a consequence, the voltages will decay and will change polarity. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

***Feedback and stabilisation***

The Standby Power Supply always oscillates at maximum power. The only limiting factor is the maximum primary current, which has been pre-set with R3108//3118.
R3114, R3124, R3113 and zener diode D6122 determine $U_{OUT}$. If the voltage across R3114 exceeds the threshold voltage of the diode of the optocoupler 7104 (± 1 V) or, in other words, $U_{OUT}$ exceeds 5.2 V, the transistor of the optocoupler will conduct.
Transistor TS7100 is now driven, and a negative voltage will be transposed to the emitter of TS7101. When TS7101 conducts, the gate of the FET is at earth potential, forcing the oscillator stop. Due to the load, the secondary voltage $_{OUT}$ will decrease. At a certain voltage, optocoupler TS7104 will block and the oscillator will start again.
Since there are no capacitors, and there is a high amplification factor in the feedback circuit, the feedback is ultra-fast. This is why the ripple on $U_{OUT}$ is minimal. The negative supply voltage (-13 V) used in the feedback circuit, originates from the co-coupling coil and is rectified through D6103.
Stabilisation is not affected through duty-cycle control but through burst-mode of TS7100.
Burst-mode is load dependent. If the power supply is less loaded, the secondary voltage will have the tendency to increase more rapidly. If the load on the power supply increases, then the oscillator stops less often, right up to the moment that the oscillator is operating continuously: maximum load. If the power supply is now loaded even more, the output voltage will decay. The maximum primary current set by R3108//3118 determines the maximum load.

***Protection***

If the optocoupler would fail, the secondary voltage will increase. This would have disastrous consequences since many ICs (e.g. OTC, Flash-RAM and DRAM) are fed with this 5.2 V. In other words; very expensive repairs would be required.
We already know that the negative supply is directly dependent upon the secondary 5.2 V, as a consequence of which the negative supply will increase proportionally as the secondary voltage increases.
If the negative supply in the mean time reaches -15 V, D6106 will start to zener and as a consequence TS7101 will start conducting. Basically, D6106 will take over the stabilisation task of the optocoupler, however, with a considerable spread: from -13 V to -15 V is a 15 % increase, thus $_{OUT}$ will increase from 5.2 V to max. 6 V.

***Tuner Supply***

The Standby supply produces 2 voltages for the Tuner: +33V ($V_{TUN}$) and +5VT.

- The +33V is the tuning voltage for the Tuner.
- The +5VT is derived from the +8V with stabiliser 7911, and is used to supply the tuner only.

***SSB Supply***

There are several voltages going to the SSB: +8V, +5V and +3V3.

- The +5V and +(always present) come directly from the Standby power supply.
- The +3V3 is derived from the +5V with stabiliser 7910 (on the LSP).

### 9.3.4 Main Supply (diagram A1)

Some **important** notes on beforehand:

- $V_{BAT}$ is not isolated from the main supply ('hot').
- $V_{BAT}$ is alignment free.

***Principle***

The Main Power Supply, generates the 141 V ($V_{BAT}$) and the +/- 16 V for the audio part. It is based on the so-called 'down converter' principle.

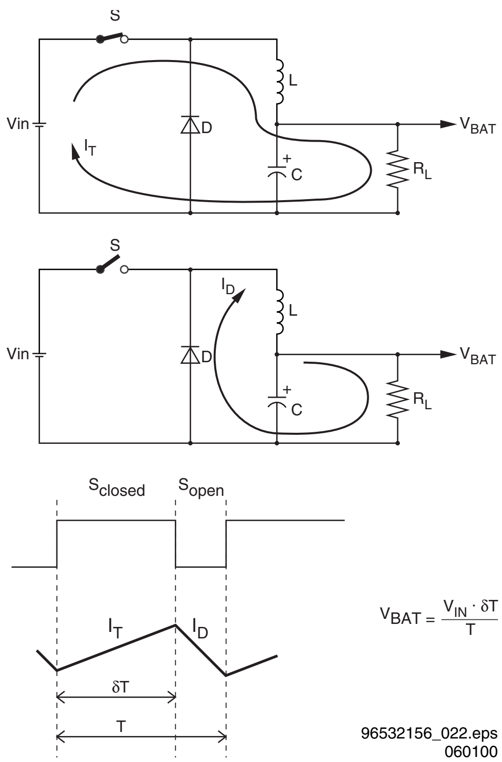



**Figure 9-5**

- After closing switch 'S', the linear in time increasing current $I_T$, will charge capacitor C.
- Opening switch 'S' will generate a counter-e.m.f. in coil L, trying to maintain current $I_T$. This is possible via diode D (this diode is also called 'freewheel diode'). So after opening 'S', the magnetic energy stored in coil L will be transferred to electrostatic energy in capacitor C. The $V_{IN}$ will only supply current during the time that 'S' is closed while a constant current is flowing through RL.
- $V_{BAT}$ is directly proportional with $V_{IN}$ and the time that 'S' is closed and reverse proportional with period time 'T'. So by changing the duty cycle, it will be possible to control $V_{BAT}$.

***Implementation***

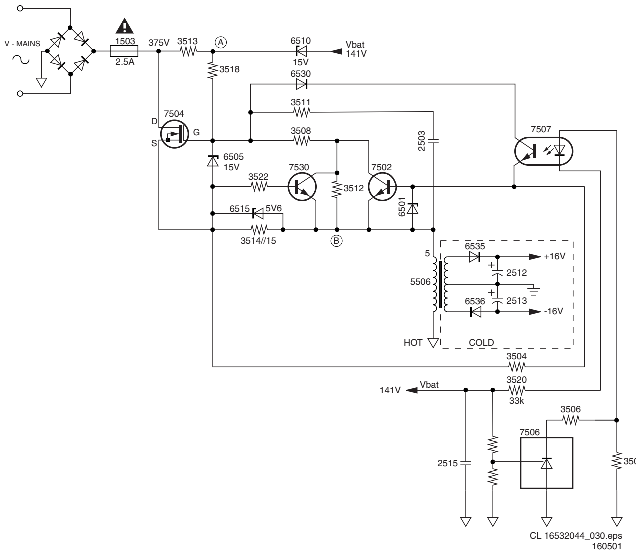



**Figure 9-6**

At start-up of the main supply, C2515 can be assumed as being a short-circuit. $U_{AB}$ will be 15 V (R3513, D6510) and $U_{GS}$ of the FET will be +5.4 V. The FET will be driven into saturation (same as closing switch 'S' ). The drain-current will increase linear in time. With other words: resistors R3513 and R3518 will start the oscillator.
The voltage across the co-coupled coil (4, 5) is also positive and will keep the FET into conductivity.

The drive concept of the MOSFET TS7504 has changed (compared to the EM2E chassis). In EM2E, TS7502 was a high-voltage semiconductor, in EM3E it is changed to a low-voltage semiconductor. The added opto-coupler 7505 is used to bridge the different voltage levels.
Via this opto-coupler, the DC-current through R3504 is influenced. The changed current through R3504, changes the $V_{BE}$ of TS7502, which will influence the drive of MOSFET TS7504 (= switch 'S' in Fig. 5).

The sudden current interruption in the primary coil, will induce a counter-e.m.f. that wants to maintain the current via the 'freewheel' diode D6508. This current is linear decreasing in time and as it is also flowing through R3414//R3415, TS7502 will be blocked after a certain time period. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

For safety reasons, transistor TS7530 is added as a back-up solution for TS7502. If B-E of TS7502 is shorted, TS7530 takes over its function.

***Stabilisation of $V_{BAT}$***

The output voltage $V_{BAT}$ is determined by: $V_{BAT} = V_{IN} * T_{ON} / (T_{ON} + T_{OFF}) = V_{IN} *$ duty-cycle.
To stabilise the output voltage, a feedback loop is implemented, which will reduce $T_{ON}$ when $V_{BAT}$ increases and vice versa.

Via a voltage divider, excisting of (1 %) resistors R3507, R3510 and R3527, a voltage of 2.5 V (when $V_{BAT}$ = 141 V) is fed to the input of precision shunt regulator 7506. This regulator will conduct, a current will flow through the diode part of the opto-coupler 7507. The base of TS7502 will now be set at a certain positive voltage. As this transistor switches the FET TS7504 on and off, this circuit can determine the duty-cycle.
E.g. when the load increases, $V_{BAT}$ will decrease. As a consequence, the input voltage of regulator 7506 will decrease, resulting in a lower current. Via opto-coupler 7505 and transistor TS7502, $T_{ON}$ of the FET is changed (will increase). The output voltage $V_{BAT}$ will rise.
If the load continues to increase, the regulator will block at a certain moment. $T_{ON}$ will is now at maximum value. This is the point where $V_{BAT}$ will go below 141 V and, at further increasing load, is switched 'off' (the voltage across the co-coupled coil (4, 5) will decrease, due to the increasing load. Therefore the voltage on the gate of TS7504 comes below the threshold voltage. The supply switches 'off' and an audible hiccuping can be heard).
On the other hand when the load decreases, $V_{BAT}$ will rise. As a consequence, the input voltage of TS7506 will also rise, resulting in a higher current. This changes the base voltage of TS7502, and through that the $T_{ON}$ (will decrease) of the FET. The output voltage $V_{BAT}$ will be reduced.
If, for instance, $V_{IN}$ will decrease (e.g. $U_{MAINS}$ is 180 V i.s.o. 240 V), the slope of the drain-current will be flattened, through which the FET will be longer into conductance, keeping $V_{OUT}$ constant.
If, for any reason, the stabilisation circuit might fail, the output voltage $V_{BAT}$ can never exceed 200 V (via D6514). D6514 will form a short-circuit, $V_{BAT}$ will drop and the set will switch off (this will result in an audible hiccuping of the supply).

***Switch to 'Standby' (via RC)***

When the set is switched to 'Standby' mode via the Remote Control, the Main supply is switched 'off' by the circuit around TS7529 (see diagram A1).
During 'on'-state, the Main supply is fed with line pulses via the 'SUP-ENABLE' line. They are rectified and smoothed via D6517, D6516 and C2530 and fed to TS7529. Because they are less than -13 V, this transistor is blocked. When these pulses are stopped, TS7529 will be saturated and TS7502 will switch 'off'. This will switch 'off' the Main supply.

***Set to 'On' (via 'SUP-ENABLE')***

Via the 'STANDBY' command from the OTC, the MOSFETS 7141 and 7131 are switched 'on'. When the +5V and +8V are sensed by the OTC, a command is given to the HOP to start the drive (via $I^2C$).
When this is sensed via the 'SUP-ENABLE' line (at the base of line transistor TS7421), the main supply is switched 'on' via TS7529.

***Audio Supply***

The pulses on the secondary winding of L5506 are rectified by D6535 (+16 V) and D6536 (-16V), and smoothed by C2542 and C2543.

## 9.4 Control (diagram B5)

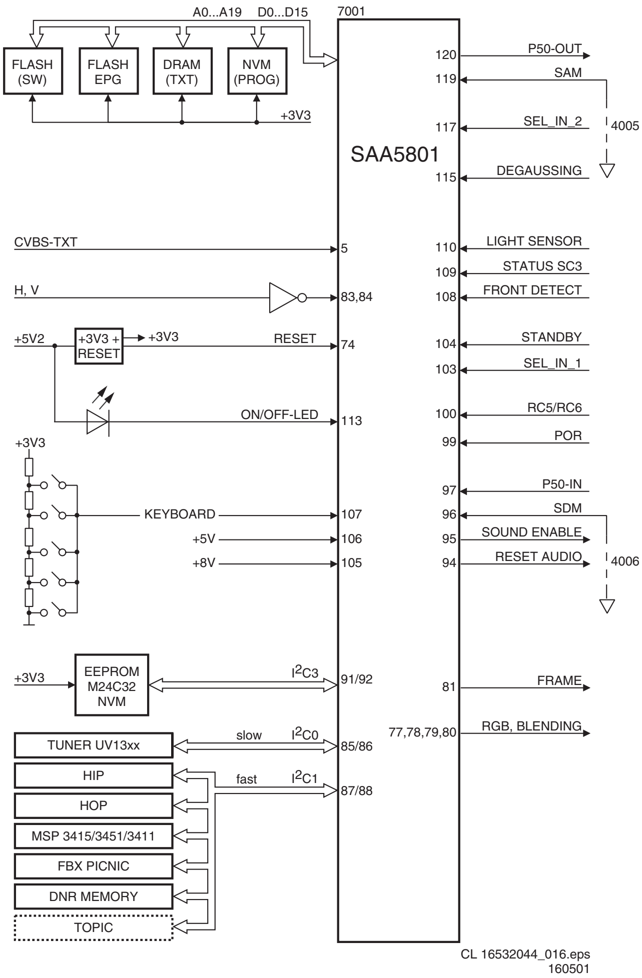



Figure 9-7

### 9.4.1 OTC

***Introduction***

The SAA5801 (IC7001) is called the OTC (OSD, TXT and Control). In this IC, the microprocessor and the TXT-decoder (level 2.5) are integrated.
Some of its functions are:
- Set control.
- TXT/OSD acquisition.
- RGB-outputs to the HOP
- Menu blending; for blending the contrast, software controlled.
- I/O-ports for $I^2C$, RC5/RC6, LED, and service modes.
- Error code generation.

***Data Storage***

The software for EM3E can be 2 MB (Megabyte).
It is possible to store 1200 TXT pages in IC7007. This is a DRAM of 4 MBit and this IC is also used to store data of a working set.
For EPG a Flash-RAM (7012) is used.
The Non Volatile Memory IC7011 is a 4 kB version M24C32W6.

***Power Supply***

All ICs in this part are supplied with 3V3. For this voltage a 3V3 stabiliser is used (IC7005).

With the circuitry around TS7003 and 7004 (diagram B5) a reset is generated to wake up the OTC (pin 74). During this reset all I/O pins of the OTC are made ‘high’.

Via pins 105 and 106, the +8 V and the +5 V are sensed. If one of them is not present, the Main supply is switched ‘off’ (set in protection and the red LED will blink at 3 Hz).
The OTC will generate an error code to indicate what was wrong.

***OSD/TXT***

The horizontal ($H_{D100}$) and vertical ($V_{SYNC}$) sync pulses are also fed to the OTC for stable OSD and TXT.
The RGB-outputs (77/78/79) together with fading (pin 80) are fed to the HOP. The fading pin has a double function: it is used for making a transparent menu and as fast-blanking signal for TXT.

### 9.4.2 $I^2C$ Busses

In the EM3E chassis with OTC-processor there are three $I^2C$ busses used:
- Slow (max. 100 kHz) hardware $I^2C$-bus (called $I^2C0$), used for the Tuner.
- Fast (max. 400 kHz) hardware $I^2C$-bus (called $I^2C1$), used for all ICs.
- Separate short bus (called $I^2C3$) for the Non Volatile Memory (NVM), to avoid data corruption.

### 9.4.3 NVM

The Non Volatile Memory contains all set related data that must be kept permanently, such as:
- Software identification.
- Operational hours.
- Error-codes.
- Option codes.
- All factory alignments.
- Last Status items for the customer + a complete factory recall.
- Txt featuring (keeping habit watch data).
- EPG data.

## 9.5 Tuner & IF (diagram A8 & B2)

The tuner is $I^2C$ controlled, and is capable of receiving off-air, S- (cable) and Hyperband channels:
- Low 44 - 156 MHz
- Mid 156 - 441 MHz
- High 141 - 865 MHz

The tuning is done via $I^2C$. The reference voltage on pin 9 is 33 V. This voltage ($V_{TUN}$) is derived from the secondary side of the standby supply, via D6134 and R3116//R3115 and a 33 V zener diode (D6200). The OTC, together with the HIP, controls the tuning procedure. There is also automatic switching for the different video systems.

The IF-filter is integrated in a SAW (Surface Acoustic Wave) filter. The type of this filter depends on the received standard(s). There are two SAW filters: one for filtering picture-IF and a second one for sound-IF. An extra filter (5403), tuned at 40.4 MHz, is necessary for L/L’ sets (with 6.5 MHz sound), to suppress the neighbour channel.

The output of the tuner is controlled via an IF-amplifier with AGC-control. This is a voltage feedback from pin 62 of the HIP to pin 1 of the tuner. AGC take-over point is adjusted via the service alignment mode ’Tuner AGC’. If there is too much noise in the picture, it is possible that the AGC setting is wrong. It is also possible that the AGC-setting is mis-aligned, if the picture deforms with a perfect signal. Then the IF-circuit amplifies too much.

The video IF-signal is fed to pins 2/3 of the PLL-controlled IF-demodulator. The voltage controlled oscillator of the PLL is

adjusted via the service menu 'IF AFC'. If the alignment is correct, the displayed frequency in the installation menu is the same as the applied frequency from a generator. The external coil L5408 connected between pins 7/8 is used as reference.
The demodulated IF-video signal is available at pin 10 of the HIP. In this video signal, there is a rest of the sound carrier, which is filtered out by the sound trap 1407.
Then the signal is again fed to the HIP on pin 12, where the group delay is corrected, dependent on the standard that is received.
The CVBS-signal is available at pin 13 for further processing in the set. Via TS7322, the signal is supplied to EXT1 (monitor out) and again back into the HIP (pin 14) to the source/record selection.

To realise Quasi Split Sound (QSS), the IF-signal is fed to the HIP on pin 63/64 via SAW-filter 1405. The FM (or AM for L-norm) -modulated signal is available on pin 5 and is fed to the audio demodulator MSP34xx (7651).

## 9.6 Video: High-end Input Processor (HIP, diagram B2))

In the EM3E, the HIP TDA932xH is used, which contains the following functions:
- IF demodulation.
- Group delay correction.
- AFC signal generation, used to track drifting transmitters.
- Sound carrier re-generation (SIF).
- AM demodulation.
- Sync acquisition, delivering $H_A$ and $V_A$.
- Switching off IF-filtering.

### 9.6.1 Inputs

The HIP has various inputs:
- Full matrix switch with:
  - 2 CVBS inputs
  - 2 Y/C (or additional CVBS) inputs
  - 1 CVBS front end input.
- Two RGB inputs and 2 status-inputs

The input signals from the Front I/O are fed to the HIP, and front detection is fed to the OTC.
- EXT1 is full SCART: thus CVBS and RGB. The RGB-selection is done in the HIP.
- EXT2 is meant for VCR and has therefore some additional signals in relation to EXT1 but no RGB. EXT2 has also the possibility for Y/C_in and Easylink-Plus (P50). Y_in is with pin 20 and Chroma in with pin 15. Easylink is handled via pin 10 of the SCART and this is a bi-directional communication.
- EXT3 is meant for CVBS input only.

### 9.6.2 Outputs

One can select three, separate switchable, outputs:
- 1 YUV-output, which is fed to the PICNIC
- 2 CVBS outputs, one for Teletext Dual Screen and the other for output to EXT2 to have WYSIWYR (What You See Is What You Record).

### 9.6.3 I/O Switching

The external signals are fed directly to the I/O part of the HIP with status from pin 8 of SCART. On the HIP there are two status inputs available (pins 15, 17) with two voltage levels:
- 4:3 -> 2.2 V
- 16:9 -> 5.5 V

### 9.6.4 P50

Easylink supports the next features:
- Signal quality and aspect ratio matching
- One touch play
- One touch text
- Pre-set download
- WYSIWYR
- Automatic Standby

With Easylink-Plus (P50+) is added:
- Country and language installation
- System Standby
- Intelligent set top box features
- NexTView download
- Timer record control
- VCR control feature

### 9.6.5 Video Processing

The sandcastle-pulse of the HIP is not used for synchronisation. The HOP will generate synchronisation signal derived from the feature box (PICNIC) signals. If a VCR is connected, there is also an automatic correction for MacroVision. This is active for the external sources and the pre-sets 0, 90-99.
The HIP itself (no external voltage) controls the Y/C switch in the HIP.
The chrominance decoder in the HIP is full multi-standard: PAL/SECAM/NTSC.
Two different crystals can be connected to the pins 54 & 57 without any alignment. The crystals are also used as a reference for the synchronisation. A digital control circuit that is locked to the reference signal of the colour decoder determines the start-up of the sync. The original one may only replace this crystal. If just a crystal is taken, the internal capacitance will be different and the effect will be that there is no colour.
In the HIP a sync separation circuit is integrated; the HIP delivers the $HA_{50}$ and $VA_{50}$ to the PICNIC.

## 9.7 Video: Feature Box (PICNIC and FALCONIC, diagram B3)

### 9.7.1 Introduction

The basic function of the Feature box (FBX6) is picture improvement, and depending on the version, several scan conversion methods are possible. The PICNIC (SAA4978H) is the central key component.
In the EM3E-chassis, the feature-box is integrated on the SSB.
The PICNIC is used for the 100Hz conversion and has the following functions:
- The ADC.
- The DAC.
- The 100 Hz conversion.
- Dual screen compression
- The Panorama mode.
- Automatic Aspect Ratio Adaptation (AARA)
- Colour Transient Improvement (CTI)
- The contrast improvement (Dynamic Contrast).

All these functions are integrated in one IC: SAA4978H, 160 pins QFP

### 9.7.2 ADC/DAC

Analogue to Digital conversion is done with three identical 9-bit ADC's.
Digital to Analogue conversion uses three identical 10-bit DAC's.
In the PICNIC there are three 9 bits ADCs present for Y,U,V. For digitising the Y (luminance), 9 bits are used (to realise a

more detailed picture). These 9 bits are only internally used. Via dithering the 9 bits are reduced to 8 bits and this data is stored into memory. The data in the memory is fed back to the PICNIC and via un-dithering the data is again reproduced to 9 bits for processing.
U/V (colour difference signals) is also sampled with 9 bits. These two 9 bit data streams are multiplexed to 4 bits data streams. As the perception for colours by the human eye is less sensitive as for luminance, this reduction is allowed.

#### 9.7.3 100 Hz Conversion

The main task of the PICNIC is the conversion from 50Hz to 100Hz for YUV and HV-sync. In order to remove 'large area flicker' (especially visible in a white picture), the field-rate of the video is doubled by the FBX6. A 50/60 Hz frame frequency is converted to 100/120 Hz. Also the line frequency (16 kHz) is doubled (32 kHz).
Basically, when the video input contains fields A, B etc..., the conversion provides an AABB sequence on the display. The actual conversion is done in the first Field Memory (by reading it twice at double speed, while writing it once.

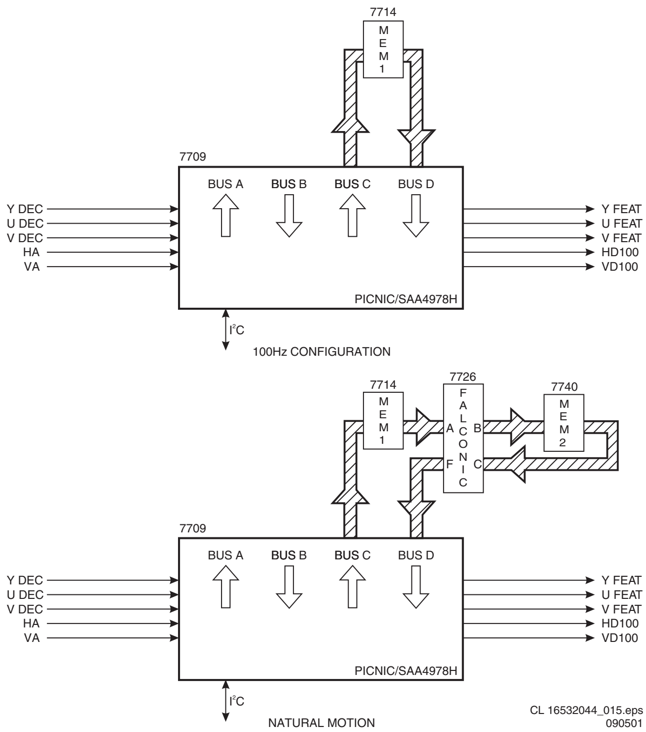



**Figure 9-8**

For extra 100 Hz features, it is possible to add an extra IC to the PICNIC. This IC, called the ‘Field And Line CONverter IC’ (FALCONIC), has three modes:

1. **100 Hz** (to eliminate field flicker). Only one memory IC (7714) is used to store one frame. It displays an AABB sequence.
2. **Digital Scan** (to additional eliminate line flicker). Together with two memory ICs (7714 and 7740), it displays an AA’BB’ or ABAB sequence.
3. **Natural Motion** (to additional eliminate movement juddering).
   Together with two memory ICs (7714 and 7740), it displays an AB’A’B sequence.

#### 9.7.4 Dual Screen Compression

The PICNIC can provide horizontal video compression up to 50 %. The compress mode can be used to display dual screens with Teletext (only for wide-screen sets).

#### 9.7.5 The Panorama Mode

To fit 4:3 pictures into a 16:9 display, it is possible to apply a panoramic horizontal distortion, to make a screen-fitting picture without black sidebars or lost video.
The centre horizontal gain is programmable and the side gain is automatically adapted to make a screen-fit.

#### 9.7.6 Automatic Aspect Ratio Adaptation (AARA)

This feature uses data from the 'black bar detection circuit' to adapt the vertical and horizontal amplitude to an aspect ratio belonging to the display, without the black bars.

#### 9.7.7 Colour Transient Improvement (CTI)

At CVBS video signals, the bandwidth of colour signals is limited to 1/4 of the luminance bandwidth. Transients between areas of different colours are therefore not very sharp.
The PICNIC can steepen these transients artificially with a time manipulation algorithm.

#### 9.7.8 Dynamic Contrast

To make the contrast (black/white) range wider, Philips has invented Dynamic Contrast. It uses the digital memory used in 100 Hz sets. It measures every A-field (25 x per second), and digitally analyses where on the greyscale most of the image is located.
If it is a relatively dark image, the lighter part of that image is stretched towards white, so that more contrast will become visible in that picture.
If it is a relatively light image, the darker part of that image is stretched towards black, so that these darker parts will have more contrast.
When the image is in the middle of the greyscale, both dark and light parts are stretched.

## 9.8 Video: High-end Output Processor (HOP) and TOPIC (diagram B4)

#### 9.8.1 General

The YUV-signals from the PICNIC are fed to the HOP (High-end Output Processor, TDA9330). The video and geometry control parts are integrated in the HOP. Also the RGB-signals for TXT/OSD (from the $\mu$P), are inserted via the HOP. The geometry part delivers the H-drive, EW-drive, V-drive and also a drive signal for rotation.

The main functions of the HOP are:

- Video control (contrast, brightness, saturation, etc.).
- Deflection drive.
- 2nd RGB interface for OSD/TXT.
- Peak White Limiting.
- Cut-off control and White Drive (RGB outputs).
- Geometry control.

The TOPIC (The most Outstanding Picture improvement IC, item 7302, type TDA9178), is an **optional** IC between the PICNIC and the HOP. It has the following (picture improvement) functions:

- Luminance Transient Processor (LTP), for detail enhancement.
- Chrominance delay circuitry, to compensate timing differences between Y and C.
- Spectral processor , for improved sharpness and colour transient improvement (CTI).
- Colour vector processor, for skintone correction, green enhancement and blue stretch.
- Measure and detection circuitry, for AutoTV.

The sandcastle pulse from the HOP is fed to pin 1 of the TOPIC, which is used as reference for timing.

#### 9.8.2 Video Control

After source selection, the HOP controls the signals for Saturation, Contrast and Brightness. Output is RGB again.

#### 9.8.3 OSD/TXT Control

On pins 35 to 38 the RGB and fast blanking from the OTC (OSD and TXT) are inserted. The sync signal $V_{SYNC}$) is derived from the ‘FRAMEDRIVE-“ signal.

#### 9.8.4 Peak White Limiting

On pin 43 there is a Peak White Limiting signal line (PWL). If the beam current increases, the ‘EHT-info’ voltage will decrease. Average limiting via R3343/C2333 controls PWL.

#### 9.8.5 Cut-off Control

The following will happen when you switch the TV to Standby:
1. The vertical scan is completed.
2. The vertical flyback is completed (the horizontal output is gated with the flyback pulse, so that the horizontal output transistor cannot be switched ‘on’ during the flyback pulse).
3. The ‘slow stop’ of the horizontal output is started, by gradually reducing the 'on' time at the horizontal output from nominal to zero (this will take 50 ms).
4. At the same time, the fixed beam current is forced via the black-current-loop for 25 ms. This is done by setting the RGB outputs to a maximum voltage of 5.6V.

In the EM3E a **'one-point'** cut-off control is used:
A current of 8 $\mu$A (for cut-off) is fed to pin 44 of the HOP. This is done with a measurement pulse during the frame flyback. During the 1st frame, 3 pulses are generated to adjust the cut-off voltage at a current of 8 $\mu$A. With this measurement the black level at the RGB-outputs is adjusted.
So at start-up there is no monitor pulse anymore. At start-up, the HOP measures the pulses, which come back via pin 44. The RGB-outputs have to be between 1.5 V and 3.5 V. If one of the outputs is higher than 3.5 V or one of them lower then 1.5 V, the RGB-outputs will be blanked.

#### 9.8.6 Geometry control

All geometry control is done via $I^2C$ and the data is stored in the NVM (IC7011) of the SSB.

#### 9.8.7 Deflection Control

***Line Drive***
The Line drive is derived from an internal VCO of 13.75 MHz. As a reference, an external resonator is used (1301). The internal VCO is locked with the $HD_{100}$-pulse, which comes from the PICNIC.
The 'PHI-2' part in the HOP receives the HFB_X-RAY_PROT (pin 13) to correct the phase of the Line drive. The EHT-info is supplied to pin 14 (DYN-PHASE-CORR) to compensate picture breathing depending on the beam current.
Note: This is not used in the EM3E, therefore EHT-compensation in the SAM menu is put to zero.

***Frame Drive***
At pins 1 and 2 the symmetrical frame drive signals are available. The $V_{SYNC}$ signal, for synchronisation of the OSD/ TXT, is derived from the ‘FRAMEDRIVE-‘ signal.

***East/West Drive***
At pin 3, the E/W-drive is available. Pin 4 is a feedback input for the EHT-info, and is used to prevent pumping of the picture. The EHT varies also dependent on the beam current. For wide-screen without load this is 31.5 kV and with load (1.5 mA) 29.5 kV.

***Frame Rotation***
For frame rotation, a control voltage is used from pin 25 of the HOP. Frame rotation is only used in wide-screen sets.

#### 9.8.8 Protections

***Flash detection***
When a flash occurs, the EHT-info will become negative very fast. Via R3316/D6304/D6303, TS7303 starts to conduct. This makes pin 5 of HOP ‘high’. The output (pin 8) is immediately stopped.
If the H-drive stops, then also pin 5 will become ‘low’ again, which will reset the flash detection.
A bit (FLS) is set in an output status register, so that the OTC can see that there was a flash. This FLS-bit will be reset when the OTC has read that register.

***HFB protection***
If the HFB is not present, it this detected via the HOP. The OTC puts the TV into protection and reads a register in the HOP. An error code is generated.

## 9.9 Synchronisation (diagram B2, B3 & B4)

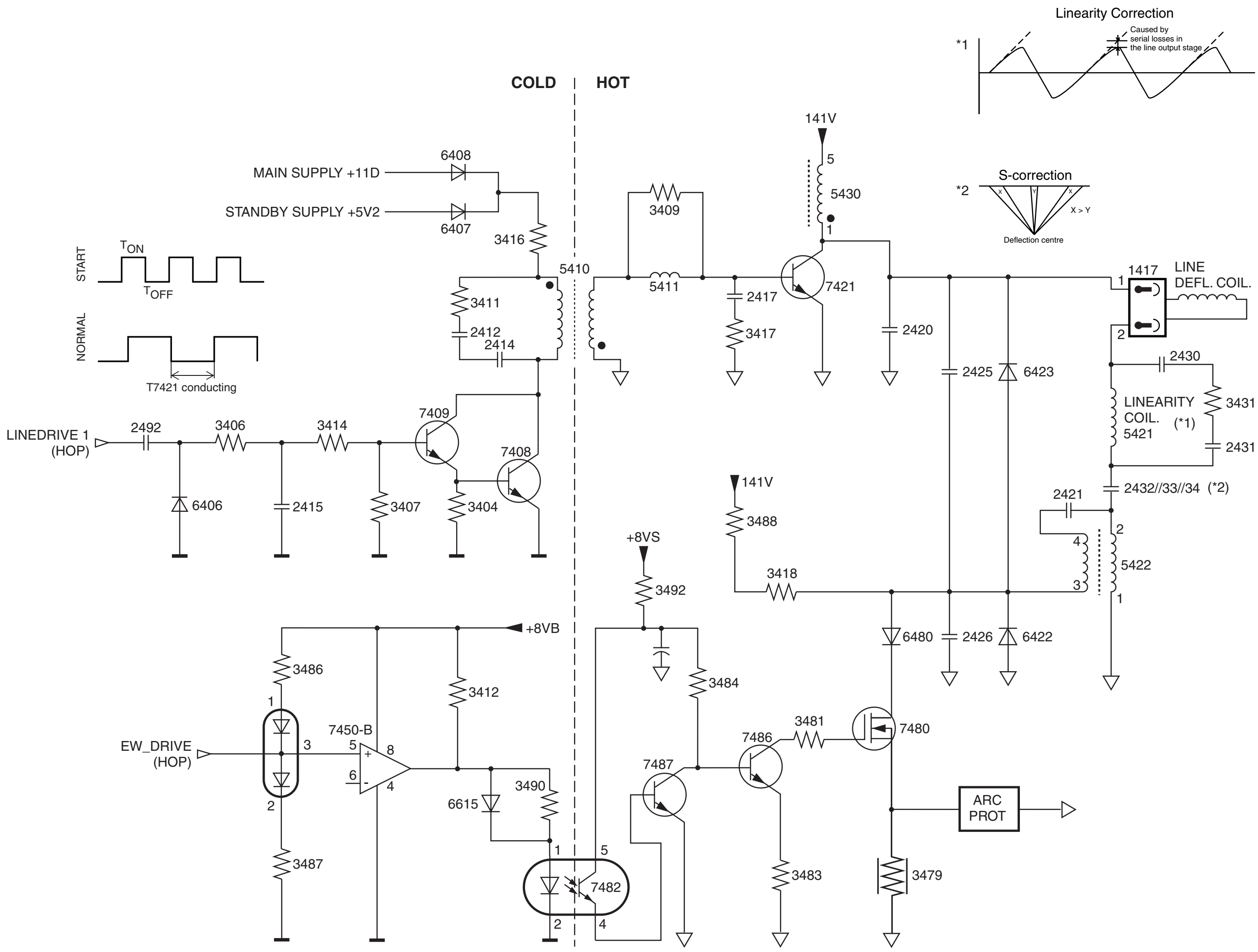
The HIP video processor provide the vertical and horizontal sync pulses $V_A$ and $H_A$. They are synchronised with the incoming CVBS signal. Then these pulses are fed to the PICNIC, where they are doubled to be synchronous with the 100 Hz picture. The outgoing pulses, $VD_{100}$ and $HD_{100}$, are fed to the HOP, which supplies the vertical and horizontal drive pulses and the 100 Hz ($2f_H$) sandcastle pulse.

The $VD_{100}$ pulse from the PICNIC is inverted by TS7304 to the $V_D$ signal. The OTC is synchronised on the HFB pulse from the CRT and on the $V_{SYNC}$ from the HOP, for the synchronisation of TXT/OSD/EPG

When no CVBS is offered to the video processor, the $V_{A50}$ and $H_{A50}$ pulses are switched ‘off’ by the HIP, and the pulses are generated by the PICNIC (to assure a stable OSD).

## 9.10 Horizontal (Line) Deflection (diagram A3)

### 9.10.1 Principle




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140501

**Figure 9-9**

The HOP (located on the SSB) generates the line-drive pulses (LINEDRIVE1), which have a frequency of 31250 Hz (T = 32 $\mu$s).

When the LINEDRIVE1 signal is high, TS7409 and TS7408 will conduct. A constant DC voltage will be applied across L5410, causing a linear increasing current through this coil. The secondary voltage of L5410 has a negative polarity so that TS7421 will block. When the set is switched ‘on’, the current through L5410 is supplied by the 5V2 Standby supply (via D6407), and taken over by the +11D voltage (via D6408) of the main supply.

When the LINEDRIVE1 signal becomes low, TS7409 and TS7408 will block. The voltage polarity across the primary winding of L5410 will invert. The positive voltage on the secondary winding will now drive TS7421 into conductivity. Because of the storage time of the line transistor (TS7421), L5410 cannot transfer its energy immediately to the secondary side. This may result in high voltage peaks on the collector of TS7409 and TS7408. To prevent that these peaks will damage the transistors, a 'snubber' circuit (C2414, C2412 and R3411) will suppress them.

When the LINEDRIVE1 signal is high again, the above described sequence starts again. Circuit L5411 and R3409 will increase the switch ‘off’ time of the line transistor.

The line stage is started via a 'slow start' principle. During start-up, the HOP generates line drive pulses with a small $T_{ON}$ and a high frequency (50 kHz). $T_{OFF}$ is constant and $T_{ON}$ is gradually increased until the frequency is 31.25 kHz (normal condition).
The time interval from start to normal condition takes about 150 ms.
When switching off, the same procedure is followed, but now in reverse order.

### 9.10.2 Implementation

To explain the operation of the line output stage, we use the following start conditions:

- C2433 is charged to max. 141 V ($V_{BAT}$)
- TS7421 is driven into conductivity.

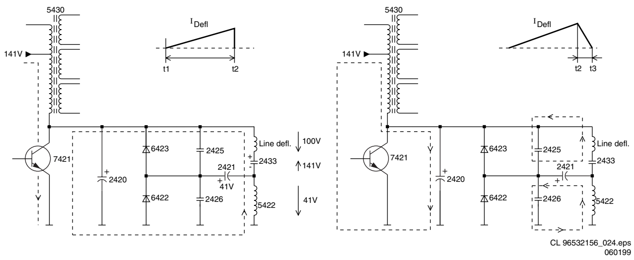



**Figure 9-10**

- **Period t1 - t2:** When TS7421 is driven into conductivity, the capacitor voltage of 141 V, will be divided across bridge-coil L5422 and the deflection coil (connector 0317). Due to the chosen inductance values, there will be 100 V across the deflection coil and 41 V across L5422. The linear increasing current in the deflection coil will result in a spot moving from the centre of the picture tube to the right. The voltage across L5422 will also charge C2421 (41 V - 0.7 V).
- **Period t2 - t3:** At the moment the LINEDRIVE signal becomes high, TS7421 will stop conducting. In the coils a voltage will be induced, trying to maintain the current. The current through the line deflection coils continues to flow through C2425 and C2421 and the current through L5422 continues to flow through C2426 and C2421. The energy stored in the line deflection coil is passed to C2425, and the energy of L5422 to C2426. The resonance-frequencies of these 2 LC-circuits define the flyback time of the spot from the right side of the picture tube to the left. On average no current flows through C2421 and thus the voltage across this capacitor remains constant.

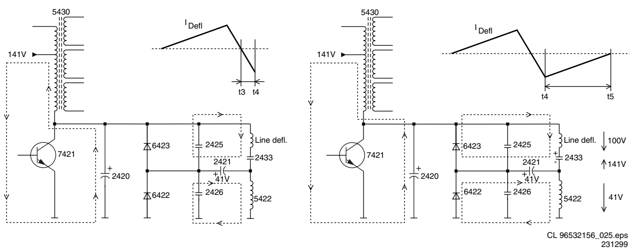



**Figure 9-11**

- **Period t3 - t4:** As for the period t2 - t3; but now the current flows in the opposite direction, since the voltage across C2425 and C2426 is higher than the voltage across C2433 and C2421.
- **Period t4 - t5:** The coils want to maintain the negative current and will charge the capacitors negative. Because of this, D6422 and D6423 will conduct. The voltage is 100 V across the deflection coil and 41 V across L5422. As both diodes conduct, we may consider the voltage to be constant. A linear current flows with the same changing characteristics as in period t1 - t2. The spot now moves from the extreme left of the picture tube to the centre. Before the current becomes zero, and the spot is located in the centre of the frame, TS7421 reverts back into conductivity. First a short negative current will flow. The cycle starts again.

### 9.10.3 Corrections

Several corrections are necessary to obtain a correct picture.

***Linearity Correction***

A constant voltage across the horizontal deflection coil should result in a linear increasing saw-tooth current. This is not the case however, as the resistance of the coil is not negligible. In order to compensate for this, a pre-magnetised coil L5421 in series with the deflection coil is used. This coil ensures that during time interval t1 - t3 the circuit resistance will be higher than during t4 - t5.
L5421 is called the linearity coil. To avoid self-oscillation, R3431 and C2431 are placed parallel to L5421.
See also Figure 9-9-(*1).

***S-correction***

Since the sides of the picture are further away from the point of deflection than the centre, a linear saw-tooth current would result in a non-linear image (the centre would be scanned slower than the sides).
To solve this, the deflection current for the right- and left side is reduced.
C2433 is charged quadratic during time interval t1 - t2. Left and right the voltage across the deflection coil decreases, causing the deflection to slow down. In the centre, the voltage increases and the deflection will be faster.
An S-shaped current is superimposed on the saw-tooth current. This correction is called ‘finger-length correction’ or ’S-Correction’.
C2433 is relatively small, as a result of which the saw-tooth current will generate a parabolic voltage with negative voltage peaks. The current also results in a parabolic voltage across C2421, resulting in the finger-length correction, proportionally increasing with the picture width.
The EW-DRIVE signal will ensure the largest picture width in the centre of the frame. Here the largest correction is applied. The larger the picture width, the higher the deflection current through C2433.
See also Figure 9-9-(*2).

***E/W-correction***

A line, written at the upper- or lower side of the screen, will be larger at the screen centre when a fixed deflection current is used. Therefore the amplitude of the deflection current must be increased when the spot approaches the screen centre. This is called East/West correction.

The EW drive signal originates in the HOP and is supplied to TS7480 via OpAmp 7450-B and optocoupler TS7482. The shape of this signal determines the various geometric correction parameters:

- H amplitude
- EW-parabola
- EW-corner
- EW-trapezium
- Horizontal parallelogram
- Horizontal bow

TS7480 will charge capacitor C2421 more or less, increasing the deflection current when reaching the centre of the screen. The moment TS7480 is driven into saturation, C2421 will discharge during the flyback. As a consequence of which C2421 must be charged again during the scan via the conduction diode D6422 (as long as C2421 is not charged to the voltage across L5422, D6422 will conduct).
The current in the deflection coil is therefore larger than the current flowing in L5422 (1-2). The voltage across the deflection coil increases, so the picture width increases.
When TS7480 blocks, C2421 will not discharge anymore, and the voltage across C2421 will remain constant.
The result is that the voltage across the deflection coil is minimal. The voltage across coil L5422, however, is maximal. This coil (L5422) consists of a transformer with the following properties:

- As the current through the coil 1-2 increases (smaller picture width), the current through coil 3-4 decreases. Because of the transformer characteristic a higher voltage will be subjected to coil 3-4, which will counteract the current. The current will diminish even further.
- When the current through coil 1-2 diminishes (larger picture width), the current through coil 3-4 increases.

*Beam-current Correction*

The ‘EHT-info’ signal at point 10 of the LOT, depends on the value of the beam-current and the voltage from divider R3450, R3451 and C2450. This signal is fed to the HOP to trim the contrast, and to compensate for the changes in picture-width as a function of the EHT-info, when EHT is decreased. The ‘EHT-info’ is also used to correct the EW-current.

The ‘DYN-FASE-CORR’ signal, derived from the ‘EHT-info’ signal, is fed to the HOP via C2455 and drives a dynamic phase correction necessary because of beam-current variations. This is done by regulating $T_{ON}$ of the line transistor TS7421.

### 9.10.4 Secondary Line Voltages

During the blocking time of TS7421, the magnetic energy of coil 1 - 5 of the LOT, is transferred to electrical energy in the secondary winding. Via rectifying and smoothing, the several secondary supply voltages are generated, like:

- EHT, Focus and Vg2-voltage
- +200V for the CRT panel (pin 8 LOT)
- +11D for the line deflection (pin 12 LOT)
- +13VLOT for the frame deflection (pin 6 LOT)
- -15VLOT for the frame deflection (pin 3 LOT)
- Filament voltage (pin 9 LOT)

## 9.11 Vertical (Frame) Deflection (diagram A4)

### 9.11.1 Frame Stage Drive

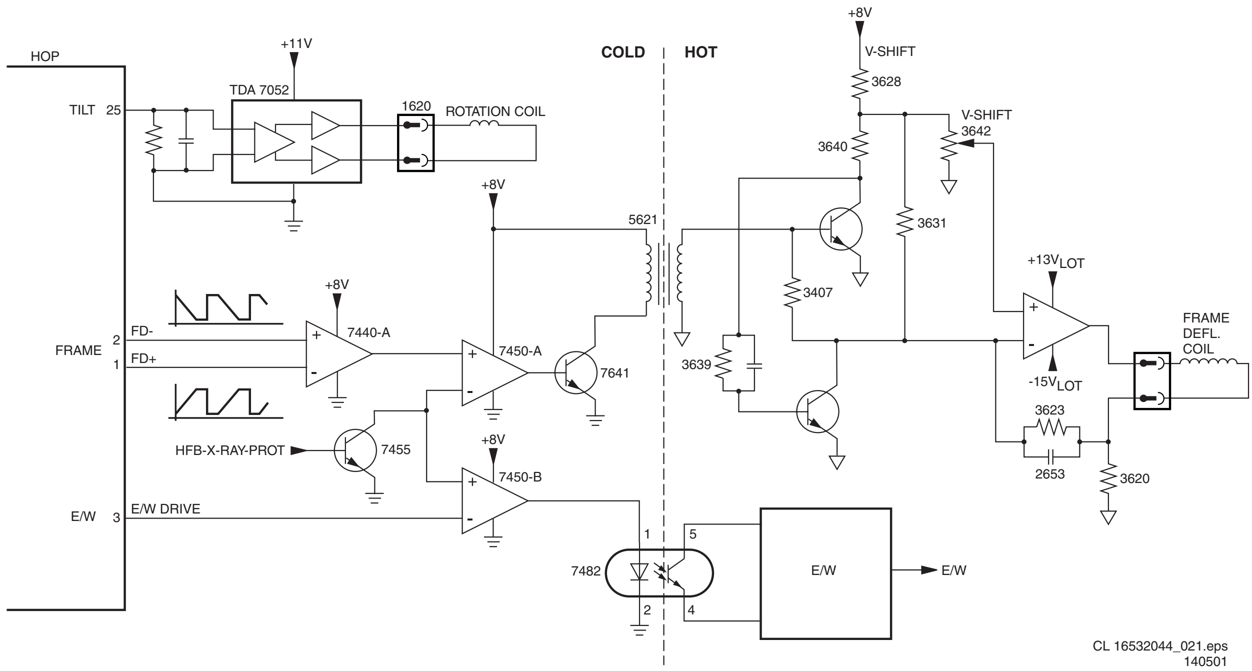



**Figure 9-12**

The HOP drives the frame output stage with a symmetrical saw-tooth voltage. As the HOP is 'cold' and the frame output stage is 'hot', they are galvanic isolated. This is done via a transformer (5621). As in the MG-chassis, the HOP generates 3 signals needed for the frame output stage: FRAMEDRIVE+, FRAMEDRIVE- and TILT (for rotation). The rotation circuit is kept at the ‘cold’ side of the chassis, to avoid the costs an extra optocoupler.
The circuit around IC7440 will amplify this signal and the output current will flow through the rotation coil.

### 9.11.2 Flyback Generator

The frame output stage is supplied via the +13 V and -15 V coming from the LOT. The output of the amplifier is 0 $V_{DC}$, so a coupling capacitor is not required.

During the (forward) scan, a supply of +13 and -15 V is sufficient to respond to the slow changing current. The internal flyback generator puts a voltage of -15 V on pin 3. Because of the voltage drop over zener diode D6622 (8.2 V), C2622 will be charged to 19 V: being 13 + (15 - 8.2 - 0.7) V. During the flyback scan, the change in current-per-time is much larger, so a higher voltage is required. The flyback generator will now generate a voltage of +13 V on pin 3. Added to the charge on C2622 this will give a flyback voltage of 32 V (depending on the CRT size, this value can differ).

The amplifier IC (IC7620, pin 5) supplies the saw-tooth current to the frame deflection coil. The current through this coil is measured via R3620//R3621//R3622 and fed back to the inverting input of the amplifier.
R3624 and C2624 on the output of the amplifier, form a filter for high frequencies and in that way also prevents oscillations.
Peak voltages on the output, e.g. as a result of a possible flash, are damped by the clamp circuit consisting of D6619, C2627 and R3627. The network consisting of R3625, R3626, R3629 and C2629 form an extra damping circuit.

### 9.11.3 Protection circuits

*Bridge Coil Protection*

The secondary voltage of the bridge coil L5422, is guarded at the diode modulator (D6421/6422) via a 10 V zener diode (6499 on diagram A3). When the bridge-coil is working properly, the average voltage on D6422 is such that this zener diode will conduct. It will drive TS7652 into saturation. When, for any reason, the secondary side of the bridge coil is shorted, the average voltage on D6422 will drop below the zener-voltage, and TS7652 will block. Now capacitor C2642 is charged. Transistor TS7407 starts conducting and the SUP-ENABLE signal is grounded via R3403. This will switch ‘off’ the main supply (see diagram A1).

***Frame Output Protection***

Via the circuit built around TS7641 the frame output stage is guarded. If the frame output stage is working properly, TS7641 and TS7652 will both conduct and thereby discharge C2642. TS7407 is blocked, so the SUP-ENABLE signal is 'high'.
If there are frame pulses missing, TS7641 will block and capacitor C2642 is charged. Transistor TS7407 starts conducting and the SUP-ENABLE signal is grounded via R3403. This will switch 'off' the main supply (see diagram A1).

***ARC Protection***

If there are 'open' connections (e.g. bad solder joints) in the *high energy* deflection circuitry, this can lead to damaging effects (read: fire). For that reason, the E/W current is sensed (via 3479//3480). If this current becomes too high, the 'thyristor' circuit (TS7653 and TS7654) is triggered. TS7442 is switched 'on' and TS7443 is forced into conduction. . The 'SUP-ENABLE' signal is shorted now to ground level, which will force the Main Power Supply to Standby mode

## 9.12 Audio (diagram B6, A6 & A7)

### 9.12.1 Introduction

All EM3E sets contain one of ITT's Multi-standard Sound Processing (MSP) ICs for sound decoding. The diversity arises because each member of the MSP-family handles its own set of sound standards:

- MSP3411: Virtual Dolby decoding.
- MSP3412: Dolby ProLogic decoding.

Both versions also handle NICAM.

The MSP IC takes care of the main FM sound decoding. AM decoding for the L system is done by the HIP. The demodulated L sound is then again source selected and processed in the MSP. The reason for this is the bad AM detection performance of the MSP. However in case of NICAM L, it is handled by the MSP.

All MSP versions contain digital audio processing, used for the basic left/right stereo sound, such as bass, treble, balance, incredible sound and spatial.
In addition to that, both versions are capable of Dolby processing:

- The MSP3411can perform 'Virtual Dolby' processing (a Dolby approved sound mode for surround sound reproduction with left/right speakers only).

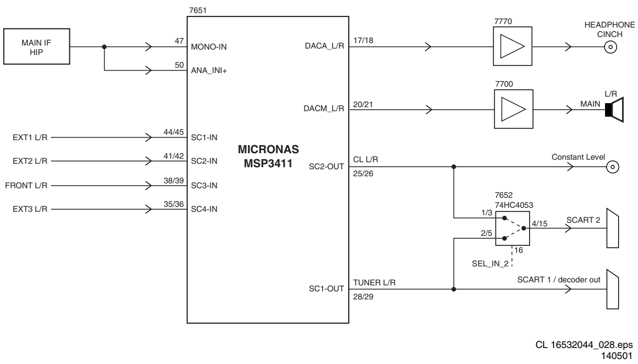



**Figure 9-13**

- The MSP3412 can perform 'Dolby ProLogic' processing (left, right and (mono) surround).

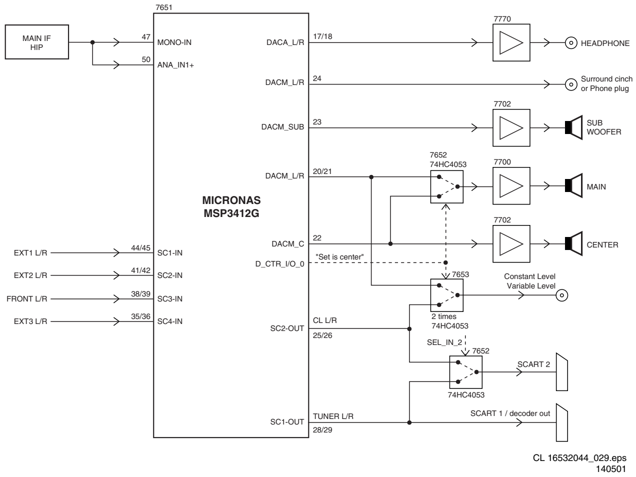



**Figure 9-14**

Following amplifier configurations are possible:

- Virtual Dolby, L/R, 2 x 15 W (88XX-series)
- 3D Surround, L/R, Centre, Subwoofer, 4 x 15 W (95XX-series).

### 9.12.2 Inputs / Outputs

Both versions can cover 4 stereo **inputs** and one AM (mono) input. This means in practice: 3 SCART inputs, 1 side input and 1 AM (mono) input.

Both versions have the following **outputs**: SCART1 (CVBS/decoder out), SCART2 (record select/WYSIWYR out) and headphone.

### 9.12.3 Source Selection

The constant level output to SCART2 is connected via a so-called 'Régimbeau' switch (IC7652) (see also Figure 9-13). This switch is needed to prevent acoustic feedback (Larsen effect). This effect is caused, when EXT2 is chosen as input signal, and the output of SCART2 is selected. This means that the main picture is also EXT2, which will cause the Larsen effect.
To prevent this, the record select must be switched to 'Tuner'. This is especially important when decoders are used, behind a 'transparent' VCR connected to EXT2.

To get a constant level output if the Tuner is selected, the SCART1 output ('Tuner' at any time), has to be fed back to the input selector and selected as input for the MSP (SCART1 input).

The MSP34XX has a separate headphone output, so sound control be done separate from the speakers.

### 9.12.4 Audio Decoding

At the input a choice can be made between two IF-signals; SIF and SIFM.
The selected signal is fed to the AGC. After this, an ADC converts the IF-signal to digital.
Two demodulation channels can process this digital signal. The first one is able to handle FM and NICAM signals. The second one can handle FM and AM signals.
Each channel contains a mixer to shift the incoming signal in the frequency domain. This shift is determined by the value of a DCO.
After the down-mix, the signal is fed, via a filter, to a discriminator. From here the AM, FM or NICAM demodulation can be performed.

Both channels contain an 'automatic carrier mute' function, which automatically mutes the output of the analogue section when no carrier is detected.
After demodulation, the FM-signals are subjected to a de-emphasis operation. After that the matrix of the stereo system is applied.

### 9.12.5 Audio Processing

The sound processing in EM3E is completely done by the MSP's:

- Volume control is done by the user via the SOUND menu.
- Tone control in 'Stereo' sets is done via the BASS/TREBLE control, in 'Virtual Dolby' sets via the 5-band equaliser.
- Headphone control, the MSP has a separate Headphone output so separate sound control is possible.

***Automatic Volume Levelling (AVL)***
One of the features of the MSP-family is Automatic Volume Limiting (AVL). If used, it limits the big volume differences in the broadcast between e.g. news transmissions and commercials, or within a movie.
To be able to get a Dolby approval (for the Virtual Dolby sets), the AVL feature must be switchable. Therefore, the AVL feature is customer switchable via the menu.

### 9.12.6 Audio Amplifier (diagram A6)

The audio amplifier is an integrated ‘class-D’ power amplifier IC, the TDA7490. It delivers an output of 2 x 15 WRMS to 2 full range speakers. For the higher specified sets, a subwoofer and centre speaker are easy to implement, by adding a second amplifier.

***Principle***
Audio-power-amplifier systems have traditionally used linear amplifiers, which are well known for being inefficient. In fact, a linear Class AB amplifier is designed to act as a variable resistor network between the power supply and the load. The transistors operate in their linear region and the voltage that is dropped across the transistors (in their role as variable resistors) is lost as heat, particularly in the output transistors. Class D amplifiers were developed as a way to increase the efficiency of audio-power-amplifier systems.

The Class D amplifier works by varying the duty cycle of a Pulse Width Modulated (PWM) signal.
By comparing the input voltage to a triangle wave, the amplifier increases duty cycle to increase output voltage, and decreases duty cycle to decrease output voltage.
The output transistors of a Class D amplifier switch from full ‘off’ to full ‘on’ (saturated) and then back again, spending very little time in the linear region in between. Therefore, very little power is lost to heat.
If the transistors have a low ‘on’ resistance $R_{DS(ON)}$, little voltage is dropped across them, further reducing losses.

The advantage of Class D is increased efficiency (= less heat dissipation). Class D amplifiers can drive the same output power as a Class AB amplifier using less supply current.
The disadvantage is the large output filter that drives up cost and size. The main reason for this filter, is that the switching waveform results in maximum current flow. This causes more loss in the load, which causes lower efficiency.
An LC filter with a cutoff frequency less than the Class D switching frequency (200 kHz), allows the switching current to flow through the filter instead of the load. The filter is less lossy than the speaker, which causes less power dissipated at high output power and increases efficiency in most cases.

The supply voltage is a symmetrical voltage of +/- 16 V (or +/- 19 V depending on the set execution), generated by the main supply via L5512 (or L5506).

***Mute***
Sound-mute is done via the STBY-MUTE line connected to pin 6 (tri-state input) of the amplifier IC. This line is activated via the SOUND-ENABLE line (software controlled) and/or POR line (hardware controlled).
This signal is inverted by TS7701 and/or TS7703, as a result of which at a high level of the SOUND-ENABLE signal, current is sinked from pin 2 and the IC mutes.

***Protection***
A loudspeaker DC protection is implemented. The amplifier IC TDA7490 has a ‘standby-mute-play’ feature via the tri-state input pin 6. When the voltage on pin 6 is:

- 0 - 0.7 V, the IC is in ‘standby’ mode
- 1.7 - 2.5 V, the IC is in ‘mute’ mode
- 4 - 5 V, the IC is in ‘play’ mode (normal operation).

**Note:** this is a ‘local’ protection, **not** known to the microprocessor.

This works as follows:

- During normal operation, $V_X$ is ‘low’ (0 V) and $V_Y$ is ‘high’ (+5 V).
- When a **positive** DC-voltage is detected on a loudspeaker output (= $V_X$ ), TS7704, TS7706 and TS7707 will conduct, making $V_Y$ ‘low’.
- When a **negative** DC-voltage is detected on a loudspeaker output (= $V_X$ ), TS7705, TS7706 and TS7707 will conduct, making $V_Y$ also ‘low’.

When $V_Y$ is ‘low’ (read 0 V), the tri-state input (pin 6) puts the amplifier IC in ‘standby’ mode.

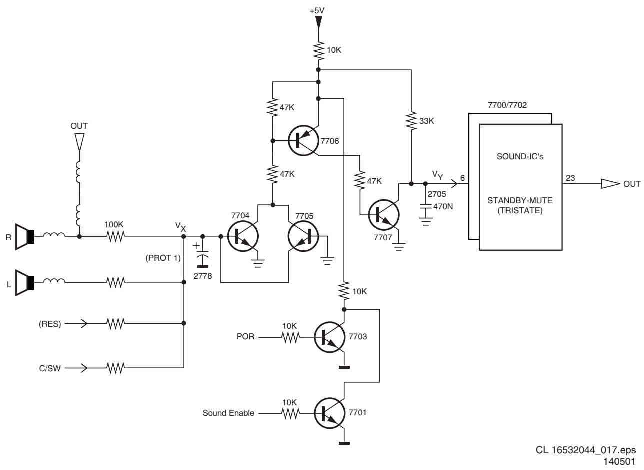



Figure 9-15

### 9.12.7 Headphone Amplifier (diagram A7)

The headphone amplifier is a straight forward OpAmp amplifier (7770, NJM4556). It is supplied with +/- 16 V.

## 9.13 Teletext and NexTView

### 9.13.1 Teletext

The TXT-decoder in the OTC gets its video signal directly on pin 5 (from the HIP).
The RGB-outputs are available on pins 77/78/79. Fast blanking is realised via pen 80.
The DRAM (IC7007) of the microprocessor is used for storage of the TXT pages.

#### 9.13.2 NexTView

NexTView allows the user to display a program guide on the TV screen, that contains extensive information for each program (only when supported by the programs provider).

This information can be displayed in a number of different summaries:
- DAY: The daily summary shows, from the current moment, the program schedule for several stations for a short time ahead.
- CHANNEL: The channel summary shows the program schedule for one station.
- THEME: The theme summary shows, for each theme, the program schedule of the various stations. These themes consist of sport, film, culture, etc. and is determined from the station side.

NexTView does not have to restrict itself to information about the station that is being viewed, but also offers information about other stations. In the various summaries 3 different commands can be given for the various program overviews. These commands appear as follows:
- WATCH: The set immediately switches over to the station concerned.
- REMINDER: The start time and date and the station of the program concerned is stored in the TV reminder list. The TV will give an OSD-message with the program information, or switch on the set at the correct moment (provided the set is in Standby) and tune to the station concerned.
- RECORD: The timer of the video recorder with ‘Easylink Plus’ is programmed with the data of the program concerned. There has to be a video recorder (with Easylink Plus) connected to SCART2 otherwise the ‘RECORD’ function will not be highlighted. The connection is via pin 10 from SCART. This means that it has to be a full SCART or at least pin 10 has to be wired.

In order to be able to realise NexTView, two teletext type data flows, Data stream 1 and 2, are transmitted with various sub-code pages of information. This data flow can transport limited information (max. 40 pages). Data stream 1 is quick repeating with a repetition time of approximately 20 to 30 seconds. However, Data stream 2 has a much longer repetition time of approximately half an hour and has a large transport capacity.
- Data stream 1 contains information of the station that is being viewed.
- Data stream 2 contains up to one week of advance information from various stations that are covered by the provider.

## 9.14 CRT / SCAVEM / Rotation (diagram F)

#### 9.14.1 RGB Amplifiers

On the CRT panel, the RGB amplifier (TDA6108, IC7307) is located. Via the outputs 7, 8 and 9 the cathodes of the picture tube are driven.
The supply voltage for the amplifier is 200 V and is derived from the LOT.

#### 9.14.2 SCAVEM

The SCAn VElocity Modulation (SCAVEM) circuitry is implemented in the layout of the picture tube panel. It is thus not an extra module. This circuit influences the horizontal deflection as a function of the picture content. In an ideal square wave, the sides are limited in slope due to a limited bandwidth (5 MHz).

***Principle***
SCAVEM will improve the slope as follows:
At a positive slope, a SCAVEM current is generated which supports the deflection current. At the first half of the slope, the spot is accelerated and the picture is darker. At the second half of the slope, the spot is delayed and the slope becomes steeper.
At the end of the slope, the SCAVEM-current decays to zero and the spot is at the original position. An overshoot occurs which improves the impression of sharpness.
At the negative slope, the SCAVEM-current counteracts the deflection. During the first half of the slope, the spot is delayed, the slope becomes steeper. During the second half the spot accelerates, the SCAVEM-current is zero at the end of the slope.

***Implementation***
Via the three resistors R33358, R33359 and R3360, Red, Green and Blue are added together, buffered and offered to the emitter of TS7300. On the collector of this transistor, configured in a common base, the sum of these 3 signals is obtained. Via the emitter follower formed with TS7301, this signal is conveyed to the differentiator C2330, R3324 and R3318. Only the high frequencies are differentiated (small RC-time).
The positive and negative pulses of this signal drive respectively TS7303 and TS7302 into conductivity. The DC setting of the output stage is set by R3304, R3308, R3316 and R3319. The working voltage of the transistors is settled at half the supply voltage.
At the positive section of the pulse, the current flows through R3318, C2307, the SCAVEM-coil and TS7303. At the negative section of the pulse, the current flows through R3318, C2309, the SCAVEM-coil and TS7302.

#### 9.14.3 Rotation

In sets with a rotation coil (wide screen sets), the amount of frame rotation is adjusted with the DAC-output of the HOP (see also 'Vertical Deflection').

## 9.15 Software Related Features

Following features are described:
- Auto TV
- ‘Switch On’ Behaviour

#### 9.15.1 AutoTV

The AutoTV (or 'Automatic Picture Control' or 'Active Control') aims at giving the customer the best possible picture performance at any time. Therefor it does real time processing of the video signal and as a result, it decides to adapt several video parameters throughout the whole chassis.

The AutoTV feature integrates traditional picture performance, AutoTV functionality and 'smart controls' in order to come to a kind of 'super smart' TV. It can be subdivided in:
- **Auto Noise Reduction.** This algorithm measures the amount of noise in the incoming video signal (this is done by the LIMERIC part of the PICNIC). As a result of this measurement, the amount of noise in the picture is corrected, starting from that noise level which is annoying for the customer. Which parameters exactly can be used is depending on the hardware.
- **Auto Sharpness.** This algorithm measures the amount of sharpness via the bandwidth of the incoming video signal and adapts the peaking frequency in the PICNIC according to this info. If the 'sharpness meter' sees the video content as 'sharp', high frequency peaking will be used. On the other hand, if the picture content is seen as

'not sharp', a low/mid frequency peaking is used. There is a coupling between the Auto Noise and the Auto Sharpness algorithm: if noise is present in the video content, then in general the sharpness will be made less aggressive. Special care has to be taken to the interaction of the LIMERIC and the vertical peaking of the PICNIC: a too big amount of vertical peaking increases the visibility of the 2DNR artefacts.

#### 9.15.2 ‘Switch On’ Behaviour

Below find the start-up sequence:

1. After the power is applied, the 'Standby supply' starts oscillating, generating the +5V2 (and +3V3). A RESET is generated and the OTC is awakened.
2. Next step is the check whether the set needs to be in ‘Standby’ mode or not. Therefore, the NVM content is read and the Standby-bit is checked. If the set is to stay in Standby, there is no further action.
3. If the set will switches 'on', first the degaussing will be activated (12 seconds). Meanwhile the MSP is reset and the Standby line is pulled low, leading to a full semi standby mode (5 V and 8V switched on)
4. The OTC waits until the +5V and the +8 V are fully present. This is done by checking the AD-input of the OTC. The +5V, +8V and $I^2C$ protection-algoritms are activated.
5. The HOP is instructed via the $I^2C$-bus to start the drive. Via the SUP-ENABLE signal, the main supply is activated. The Line Deflection circuitry is supplied now with the $V_{BAT}$, and the EHT generation can start.
6. During start-up of the deflection, $I^2C$ traffic must be disabled for 250 ms to avoid data corruption. If flashes or spikes are generated during EHT start-up, $I^2C$ data could be disturbed or corrupted.
7. After deflection is powered up completely, all the other protection-algorithms are activated. The black current stabilisation loop in the HOP is switched on. Some extra checking is done to ensure that the loops are completely stabilised. The OTC sets all the necessary parameters for a correct sound and image and unblanks the picture.

## 9.16 Abbreviation List

| | |
|---|---|
| AARA | Automatic Aspect Ratio Adaptation: algorithm that adapts aspect ratio to remove horizontal black bars; keeping up the original aspect ratio |
| ACI | Automatic Channel Installation: algorithm that installs TV sets directly from cable network by means of a predefined TXT page |
| ADC | Analogue Digital Converter |
| AFC | Automatic Frequency Control: control signal used to tune to the correct frequency |
| AGC | Automatic Gain Control: algorithm that controls the video input of the feature-box |
| AM | Amplitude Modulation |
| ANR | Automatic Noise Reduction: one of the algorithms of Auto TV |
| AR | Aspect Ratio: 4 by 3 or 16 by 9 |
| Artistic | see OTC 2.5: main processor |
| ASF | Auto Screen Fit: algorithm that adapts aspect ratio to remove horizontal black bars but without throwing away video information |
| ATV | See Auto TV |
| AUDIO_C | Audio Centre |
| AUDIO_L | Audio Left |
| AUDIO_R | Audio Right |
| AUDIO_SL | Audio Surround Left |
| AUDIO-SR | Audio surround right |
| AUDIO_SW | Audio Subwoofer |
| Auto TV | Name for the combination of picture features/improvements which work automatically (ANR / Auto sharpness/Auto Histo/ambient light). |
| BG | System B and G |
| B-SC1-IN | Blue SCART1 in |
| B-SC2-IN | Blue SCART2 in |
| B-TXT | Blue teletext |
| CL | Constant Level: audio output to connect with an external amplifier |
| ComPair | Computer aided rePair |
| CRT | Cathode Ray Tube or picture tube |
| CSM | Customer Service Mode |
| CTI | Colour Transient Improvement: manipulates steepness of chroma transients |
| CVBS | Composite Video Blanking and Synchronisation |
| CVBS-TER | CVBS terrestrial |
| DAC | Digital to Analogue Converter |
| DBE | Dynamic Bass Enhancement: extra low frequency amplification |
| DC-filament | Filament supply voltage |
| DFU | Direction For Use: description for the end user |
| DNR | Digital Noise Reduction: noise reduction feature of the box |
| DSP | Digital Signal Processing |
| DST | Dealer Service Tool: special remote control designed for dealers to enter e.g. service mode |
| DVD | Digital Versatile Disc |
| DYN-FASE-COR | Dynamic phase correction |
| EHT | Extra High Tension |
| EHT-INFO | Extra High Tension information |
| EPG | Electronic Program Guide: system used by broadcasters to transmit TV guide information (= NexTView) |
| EW | East West, related to horizontal deflection of the set |

| | |
|---|---|
| EXT | External (source), entering the set via SCART or via cinches |
| FBL | Fast Blanking: DC signal accompanying RGB signals |
| FBX | Feature Box: part of small signal / separate module which contains 100 Hz processing, extra featuring and AutoTV algorithms |
| FILAMENT | Filament of CRT |
| FLASH | Flash memory |
| FM | Field Memory or Frequency Modulation |
| G-TXT | Green teletext |
| HA50 | Horizontal Acquisition 1fh: horizontal sync pulse coming out of the HIP |
| HD100 | Horizontal Drive 2fh: horizontal sync pulse coming out of the feature-box |
| HFB | Horizontal Flyback Pulse: horizontal sync pulse from large signal deflection |
| HIP | High-end video Input Processor: video and chroma decoder of EM3E |
| HOP | High-end video Output Processor: video, sync and geometry controller of EM3E |
| HP | Headphone |
| Interlaced | Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in ‘pairs’, causing line flicker. |
| Last Status | The settings last chosen by the customer and read and stored in RAM or in the NVM. They are called at start-up of the set to configure it according the customers wishes |
| LDP | Line Deflection Protection |
| LED | Light Emitting Diode |
| LINE-DRIVE | Line drive signal |
| LNA | Low Noise Adapter |
| LSP | Large signal panel |
| MSP | Multi-standard Sound Processor: ITT sound decoder of EM3E |
| MUTE | Mute-Line |
| NC | Not Connected |
| NVM | Non Volatile Memory: IC containing TV related data e.g. alignments |
| O/C | Open Circuit |
| ON/OFF LED | On/Off control signal for the LED |
| OSD | On Screen Display |
| OTC | On screen display Teletext and Control; also named Artistic (SAA5800) |
| P50 | Project 50 communication: protocol between TV and peripherals |
| PCB | Printed Circuit board |
| PICNIC | Peripheral Integrated Combined Network IC: main IC for 100 Hz featuring and feature processing |
| Progressive Scan | Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution. |
| PTP | Picture Tube Panel |
| RAM | Random Access Memory |
| R-TXT | Red teletext |
| RC | Remote Control |
| RC5 / RC6 | Signal protocol from the remote control receiver |
| RESET | Reset signal |
| ROM | Read Only Memory |
| SAM | Service Alignment Mode |
| SC | Sandcastle: pulse derived from sync signals |
| SCAVEM | Scan Velocity Modulation |
| S/C | Short Circuit |
| SIF | Sound Intermediate Frequency |
| SIMM | 80-fold connector between LSP and SSB |
| SNERT | Synchronous No parity Eight bit Reception and Transmit |
| SSB | Small Signal Board |
| STBY | Standby |
| SW | Subwoofer |
| TXT | Teletext |
| TXT DS | Teletext Dual Screen |
| μP | Microprocessor |
| U100 | U from Feature Box |
| V100 | V from Feature Box |
| VA50 | Vertical Acquisition 1Fh |
| VBAT | Main supply for deflection (mostly 141 V) |
| VD100 | Vertical Drive 2fh: vertical sync pulse from deflection |
| VFB | Vertical Flyback Pulse: vertical sync pulse coming from the feature box |
| VL | Variable Level out: processed audio output towards external amplifier |
| WYSIWYR | What You See Is What You Record: record selection that follows main picture and sound |
| XTAL | Quartz crystal |
| Y100 | Y from Feature Box |
| Y-OUT | Luminance-signal to HOP IC |

# 10. Spare Parts List

## Large Signal Panel [A]

### Various

| | | |
|---|---|---|
| 0010 | 2422 025 16374 | 2P Male |
| 0020 | 4822 267 10774 | 2P Male |
| 0032 | 4822 492 70788 | IC-SPRING |
| 0037 | 3104 304 21112 | LOT SSB SUPPORT |
| 0045 | 4822 267 10734 | 5P MALE |
| 0065 | 3104 304 22031 | LOT SPACER |
| 0066 | 3104 304 21591 | SCART SUPPORT BRACKET |
| 0150 | 4822 265 11253 | FUSE HOLDER |
| 0153 | 4822 265 11253 | FUSE HOLDER |
| 0317 | 4822 265 20723 | 2P MALE |
| 0324 | 3104 311 01881 | CABLE 7P 480mm |
| 0325 | 2422 025 16382 | 3P Male |
| 0735 | 2422 025 16407 | 3P Male |
| 0736 | 2422 025 16382 | 3P Male |
| 0936 | 2422 025 12485 | 11P Male |
| 0940 | 4822 267 10968 | 11P FEMALE |
| 0943 | 4822 267 10748 | 3P MALE |
| 0945 | 4822 267 10735 | 3P MALE |
| 0946 | 5322 268 90415 | 2P MALE |
| 0947 | 4822 267 10734 | 5P MALE |
| 1001 | 4822 252 60151 | SURGE PROTECT |
| 1002 | 2422 132 07411 | RELAY 1P 5V 5A |
| 1003 | 4822 267 10973 | 1P |
| 1200 | 4822 210 10848 | UV1316/A I U-2 |
| 1205 | 2422 025 16599 | 80P Female SIMM |
| 1501 | 4822 070 34002 | FUSE 4A |
| 1503 | 2422 086 10912 | FUSE 2,5A |
| 1901 | 4822 267 10771 | IC SOCKET 42P |
| 1902 | 4822 267 10982 | 2P |
| 8000 | 4822 320 12525 | CABLE |
| 8001 | 4822 320 20234 | EHT CABLE |
| 8015 | 4822 320 20216 | CABLE |
| | 3122 785 100 | Supply Kit Mains Supply EM2E |
| | 3122 785 100 | Supply Kit Standby Supply EM2E |
| | 3122 785 100 | Line Repair Kit EM2E |

### ⊣⊢

| | | |
|---|---|---|
| 2101 | 5322 122 32818 | 2.2nF 10% 100V |
| 2102 | 4822 124 40248 | 10μF 20% 63V |
| 2103 | 5322 122 32531 | 100pF 5% 50V |
| 2104 | 4822 123 14025 | 2200μF 20% 16V |
| 2105 | 5322 122 32531 | 100pF 5% 50V |
| 2106 | 5322 126 10223 | 4.7nF 10% 63V |
| 2107 | 5322 122 32818 | 2.2nF 10% 100V |
| 2108 | 4822 121 70162 | 10nF 5% 400V |
| 2109 | 4822 126 13482 | 470nF 80/20% 16V |
| 2110 | 5322 121 42498 | 680nF 5% 63V |
| 2111 | 4822 121 43526 | 47nF 5% 250V |
| 2113 | 4822 122 33127 | 2.2nF 10% 63V |
| 2114 | 4822 126 10206 | 2.2nF 10% 500V |
| 2200 | 4822 124 40196 | 220μF 20% 16V |
| 2201 | 4822 126 14076 | 220nF 25V |
| 2202 | 4822 126 13473 | 220nF 80-20% 50V |
| 2203 | 4822 124 41584 | 100μF 20% 10V |
| 2400 | 4822 124 11575 | 47μF 20% 160V |
| 2412 | 4822 126 13751 | 47nF 10% 63V |
| 2413 | 4822 124 12255 | 10μF 20% 50V |
| 2414 | 4822 126 13751 | 47nF 10% 63V |
| 2415 | 4822 122 33575 | 220pF 5% 63V |
| 2417 | 4822 126 14076 | 220nF 25V |
| 2419 | 4822 126 14237 | 470pF 10% 2KV |
| 2420 | 4822 121 70594 | 1nF 5% 2KV |
| 2421 | 2022 333 00086 | 470nF 5% 250V |
| 2421 | 4822 121 42634 | 560nF 5% 250V |
| 2425 | 4822 121 10526 | 9N1 5% 2KV |
| 2425 | 4822 121 70435 | 10nF 5% 2KV |
| 2426 | 4822 121 10653 | 22nF 5% 630V |
| 2426 | 4822 121 10658 | 24nF 5% 630V |
| 2429 | 4822 121 43343 | 4.7nF 10% 400V |
| 2430 | 4822 121 41857 | 10nF 5% 250V |
| 2431 | 4822 121 42077 | 6.8nF 10% 400V |
| 2431 | 4822 126 13599 | 3.3nF 10% 500V |
| 2433 | 2022 333 00086 | 470nF 5% 250V |
| 2433 | 4822 121 42634 | 560nF 5% 250V |
| 2435 | 4822 121 10526 | 9N1 5% 2KV |
| 2450 | 5322 121 42578 | 100nF 5% 250V |
| 2455 | 5322 126 10511 | 1nF 5% 50V |
| 2460 | 4822 124 40784 | 3300μF 20% 16V |
| 2461 | 4822 122 31177 | 470pF 10% 500V |
| 2462 | 4822 124 80061 | 1000μF 20% 25V |
| 2463 | 4822 122 31177 | 470pF 10% 500V |
| 2464 | 4822 124 80061 | 1000μF 20% 25V |
| 2465 | 4822 122 31177 | 470pF 10% 500V |
| 2468 | 4822 124 12297 | 4.7μF 20% 350V |
| 2469 | 4822 122 31177 | 470pF 10% 500V |
| 2480 | 4822 121 51442 | 2.2nF 10% 50V |
| 2489 | 4822 124 40433 | 47μF 20% 25V |
| 2490 | 4822 122 33891 | 3.3nF 10% 63V |
| 2491 | 4822 124 40768 | 0.47μF 20% 100V |
| 2492 | 4822 126 14076 | 220nF 25V |
| 2495 | 4822 126 13838 | 100nF 20% 50V |
| 2499 | 4822 126 13838 | 100nF 20% 50V |
| 2501 | 4822 126 11524 | 1.5nF 10% 1KV |
| 2502 | 5322 122 32818 | 2.2nF 10% 100V |
| 2503 | 5322 121 42489 | 33nF 5% 250V |
| 2505 | 4822 126 14504 | 3.3nF 20% 250V |
| 2507 | 4822 126 13589 | 470nF 275V |
| 2508 | 4822 126 14153 | 2.2nF 10%B 1KV |
| 2509 | 4822 126 14153 | 2.2nF 10%B 1KV |
| 2510 | 4822 124 12415 | 220μF 20% 400V |
| 2512 | 4822 124 12056 | 1000μF 20% 35V |
| 2513 | 5322 122 34099 | 470pF 10% 63V |
| 2514 | 5322 122 31863 | 63V 330pF 5% |
| 2515 | 4822 124 11575 | 47μF 20% 160V |
| 2518 | 4822 126 11308 | 47pF 5% 500V |
| 2519 | 5322 122 32818 | 2.2nF 10% 100V |
| 2520 | 4822 126 14585 | 100nF 10% 50V |
| 2521 | 4822 122 33216 | 270pF 5% 50V |
| 2528 | 4822 126 14585 | 100nF 10% 50V |
| 2530 | 4822 126 14585 | 100nF 10% 50V |
| 2531 | 4822 122 31169 | 1.5nF 10% 500V |
| 2535 | 4822 121 43913 | 470nF 10% 100V |
| 2536 | 4822 126 10206 | 2.2nF 10% 500V |
| 2537 | 4822 124 11913 | 22nF 20% 275V |
| 2538 | 5322 126 10223 | 4.7nF 10% 63V |
| 2600 | 4822 121 43913 | 470nF 10% 100V |
| 2601 | 4822 121 51252 | 470nF 5% 63V |
| 2602 | 4822 124 40433 | 47μF 20% 25V |
| 2603 | 4822 122 33177 | 10nF 20% 50V |
| 2604 | 4822 124 40248 | 10μF 20% 63V |
| 2610 | 4822 122 33127 | 2.2nF 10% 63V |
| 2620 | 4822 126 14076 | 220nF 25V |
| 2621 | 4822 126 13838 | 100nF 20% 50V |
| 2622 | 4822 124 40255 | 100μF 20% 63V |
| 2624 | 4822 121 51252 | 470nF 5% 63V |
| 2625 | 4822 121 51252 | 470nF 5% 63V |
| 2627 | 5322 124 40641 | 10μF 20% 100V |
| 2642 | 4822 124 40255 | 100μF 20% 63V |
| 2700 | 4822 124 21913 | 1μF 20% 63V |
| 2701 | 4822 124 21913 | 1μF 20% 63V |
| 2730 | 4822 124 81151 | 22μF 50V |
| 2731 | 4822 124 81151 | 22μF 50V |
| 2732 | 4822 124 40255 | 100μF 20% 63V |
| 2733 | 4822 124 40255 | 100μF 20% 63V |
| 2734 | 4822 124 81151 | 22μF 50V |
| 2735 | 4822 124 81151 | 22μF 50V |
| 2736 | 5322 122 31865 | 1.5nF 10% 63V |
| 2737 | 5322 122 31865 | 1.5nF 10% 63V |
| 2756 | 4822 126 13751 | 47nF 10% 63V |
| 2760 | 4822 124 80061 | 1000μF 20% 25V |
| 2761 | 4822 124 80061 | 1000μF 20% 25V |
| 2765 | 4822 124 40255 | 100μF 20% 63V |
| 2767 | 4822 124 40255 | 100μF 20% 63V |
| 2782 | 4822 126 13751 | 47nF 10% 63V |
| 2902 | 5322 122 31863 | 330pF 5% 63V |
| 2903 | 5322 122 31863 | 330pF 5% 63V |
| 2906 | 5322 122 32531 | 100pF 5% 50V |
| 2909 | 5322 122 31863 | 330pF 5% 63V |
| 2910 | 5322 122 32531 | 100pF 5% 50V |
| 2912 | 4822 124 40248 | 10μF 20% 63V |
| 2913 | 4822 126 14585 | 100nF 10% 50V |
| 2915 | 5322 122 31863 | 330pF 5% 63V |
| 2916 | 5322 122 31863 | 330pF 5% 63V |
| 2917 | 5322 122 32531 | 100pF 5% 50V |
| 2919 | 5322 122 31863 | 330pF 5% 63V |
| 2920 | 5322 122 32531 | 100pF 5% 50V |
| 2923 | 5322 122 31863 | 330pF 5% 63V |
| 2925 | 5322 122 31863 | 330pF 5% 63V |
| 2926 | 4822 124 81044 | 470μF 20% 6.3V |
| 2927 | 4822 124 40433 | 47μF 20% 25V |
| 2941 | 5322 122 31865 | 1.5nF 10% 63V |
| 2942 | 5322 122 31865 | 1.5nF 10% 63V |
| 2951 | 4822 124 21913 | 1μF 20% 63V |
| 2952 | 4822 126 13751 | 47nF 10% 63V |
| 2953 | 4822 126 13751 | 47nF 10% 63V |

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| | | |
|---|---|---|
| 3101 | 4822 053 20106 | 10M 5% 0.25W |
| 3102 | 4822 050 26801 | 680Ω 1% 0.6W |
| 3103 | 4822 050 26801 | 680Ω 1% 0.6W |
| 3104 | 4822 116 52195 | 47Ω 5% 0.5W |
| 3105 | 4822 050 26801 | 680Ω 1% 0.6W |
| 3106 | 4822 116 52256 | 2k2 5% 0.5W |
| 3107 | 4822 116 52256 | 2k2 5% 0.5W |
| 3108 | 4822 116 52182 | 15Ω 5% 0.5W |
| 3110 | 4822 052 10109 | 10Ω 5% 0.33W |
| 3113 | 4822 116 52182 | 15Ω 5% 0.5W |
| 3114 | 4822 116 83872 | 220Ω 5% 0.5W |
| 3117 | 4822 116 52195 | 47Ω 5% 0.5W |
| 3118 | 4822 050 24708 | 4Ω7 1% 0.6W |
| 3120 | 4822 051 20109 | 10Ω 5% 0.1W |
| 3123 | 4822 116 52176 | 10Ω 5% 0.5W |
| 3124 | 4822 116 52199 | 68Ω 5% 0.5W |
| 3125 | 4822 116 52182 | 15Ω 5% 0.5W |
| 3126 | 4822 050 21003 | 10k 1% 0.6W |
| 3127 | 4822 116 52289 | 5k6 5% 0.5W |
| 3200 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3201 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3250 | 4822 051 20223 | 22k 5% 0.1W |
| 3402 | 4822 117 10837 | 100k 1% 0.1W |
| 3403 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3404 | 4822 051 20471 | 470Ω 5% 0.1W |
| 3406 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3407 | 4822 117 10833 | 10k 1% 0.1W |
| 3410 | 4822 051 20479 | 47Ω 5% 0.1W |
| 3411 | 4822 116 52193 | 39Ω 5% 0.5W |
| 3414 | 4822 117 13577 | 330Ω 1% 1.25W |
| 3415 | 3198 012 31590 | 15Ω 5% 3W |
| 3415 | 4822 117 12836 | 12Ω 5% 3W |
| 3417 | 4822 116 52176 | 10Ω 5% 0.5W |
| 3418 | 4822 050 22704 | 270k 1% 0.6W |
| 3431 | 4822 052 10101 | 100Ω 5% 0.33W |
| 3431 | 4822 052 10221 | 220Ω 5% 0.33W |
| 3450 | 4822 116 52303 | 8k2 5% 0.5W |
| 3450 | 4822 116 83961 | 6k8 5% |
| 3451 | 4822 116 52257 | 22k 5% 0.5W |
| 3460 | 4822 052 10108 | 1Ω 5% 0.33W |
| 3461 | 4822 052 10108 | 1Ω 5% 0.33W |
| 3462 | 4822 052 10108 | 1Ω 5% 0.33W |
| 3463 | 4822 052 10108 | 1Ω 5% 0.33W |
| 3464 | 4822 052 10108 | 1Ω 5% 0.33W |
| 3465 | 4822 052 10108 | 1Ω 5% 0.33W |
| 3466 | 4822 052 10688 | 6Ω8 5% 0.33W |
| 3466 | 4822 052 10828 | 8Ω2 5% 0.33W |
| 3467 | 4822 052 10108 | 1Ω 5% 0.33W |
| 3468 | 4822 052 11688 | 6Ω8 5% 0.5W |
| 3475 | 4822 116 52175 | 100Ω 5% 0.5W |
| 3481 | 4822 116 52175 | 100Ω 5% 0.5W |
| 3483 | 4822 051 10102 | 1k 2% 0.25W |
| 3484 | 4822 117 11139 | 1k5 1% 0.1W |
| 3485 | 4822 117 11454 | 820Ω 1% 0.1W |
| 3486 | 4822 117 12955 | 2k7 1% 0.1W |
| 3487 | 4822 117 11449 | 2k2 1% 0.1W |
| 3488 | 4822 116 52272 | 330k 5% 0.5W |
| 3488 | 4822 116 83874 | 220k 5% 0.5W |
| 3489 | 4822 117 11449 | 2k2 1% 0.1W |
| 3491 | 4822 050 21504 | 150k 1% 0.6W |
| 3495 | 4822 051 20683 | 68k 5% 0.1W |
| 3496 | 4822 117 11507 | 6k8 1% 0.1W |
| 3497 | 4822 117 10834 | 47k 1% 0.1W |
| 3498 | 4822 051 20472 | 4k7 5% 0.1W |
| 3499 | 4822 117 10837 | 100k 1% 0.1W |
| 3500 | 4822 117 12074 | 1Ω5 10% 7W |
| 3501 | 3198 013 04710 | 470Ω 2% 1/2W |
| 3504 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3507 | 4822 050 21604 | 160k 1% 0.6W |
| 3508 | 3198 012 16820 | 6.8k 1W |
| 3509 | 2322 595 90021 | VDR DC 1M A/495V |
| 3510 | 4822 117 11951 | 2k 1% 0.1W |
| 3511 | 4822 116 52276 | 3k9 5% 0.5W |
| 3512 | 4822 116 52297 | 68k 5% 0.5W |
| 3513 | 4822 116 52272 | 330k 5% 0.5W |
| 3514 | 4822 053 10108 | 1Ω 5% 1W |
| 3515 | 4822 053 10108 | 1Ω 5% 1W |
| 3516 | 4822 116 10075 | 9Ω 220V |
| 3518 | 4822 050 11204 | 120k 1% 0.4W |
| 3519 | 4822 051 20223 | 22k 5% 0.1W |
| 3520 | 4822 053 11333 | 33k 5% 2W |
| 3521 | 4822 117 10118 | 1M 5% 0.5W |
| 3522 | 4822 116 83961 | 6k8 5% |
| 3523 | 4822 051 20105 | 1M 5% 0.1W |
| 3524 | 4822 051 10102 | 1k 2% 0.25W |
| 3525 | 4822 051 20479 | 47Ω 5% 0.1W |
| 3526 | 4822 116 83303 | 1Ω 2W |
| 3527 | 4822 117 11454 | 820Ω 1% 0.1W |
| 3528 | 4822 117 10833 | 10k 1% 0.1W |
| 3529 | 4822 051 20472 | 4k7 5% 0.1W |

| | | |
|---|---|---|
| 3530 | 4822 116 52297 | 68k 5% 0.5W |
| 3531 | 4822 117 10833 | 10k 1% 0.1W |
| 3533 | 4822 051 20159 | 15Ω 5% 0.1W |
| 3535 | 4822 051 20273 | 27k 5% 0.1W |
| 3536 | 4822 117 10837 | 100k 1% 0.1W |
| 3537 | 4822 117 10833 | 10k 1% 0.1W |
| 3538 | 4822 051 20332 | 3k3 5% 0.1W |
| 3539 | 4822 117 10833 | 10k 1% 0.1W |
| 3540 | 4822 117 10834 | 47k 1% 0.1W |
| 3541 | 4822 117 10833 | 10k 1% 0.1W |
| 3542 | 3198 012 11570 | 0Ω15 5% 1W |
| 3543 | 4822 051 20478 | 4Ω7 5% 0.1W |
| 3544 | 4822 051 20479 | 47Ω 5% 0.1W |
| 3600 | 4822 050 22205 | 2M2 1% 0.6W |
| 3601 | 4822 050 22205 | 2M2 1% 0.6W |
| 3602 | 4822 051 20332 | 3k3 5% 0.1W |
| 3603 | 4822 101 11319 | 100Ω LIN |
| 3605 | 4822 051 20273 | 27k 5% 0.1W |
| 3606 | 4822 051 10102 | 1k 2% 0.25W |
| 3607 | 4822 051 20223 | 22k 5% 0.1W |
| 3608 | 4822 051 20223 | 22k 5% 0.1W |
| 3609 | 4822 101 11193 | 47k 30% LIN 0.1W |
| 3610 | 4822 051 20683 | 68k 5% 0.1W |
| 3611 | 4822 051 20822 | 8k2 5% 0.1W |
| 3612 | 4822 051 20274 | 270k 5% 0.1W |
| 3613 | 4822 051 20274 | 270k 5% 0.1W |
| 3614 | 4822 050 21005 | 1M 1% 0.6W |
| 3615 | 4822 050 18204 | 820k 1% 0.4W |
| 3615 | 4822 116 52292 | 560k 5% 0.5W |
| 3616 | 4822 116 52285 | 470k 5% 0.5W |
| 3617 | 4822 050 11002 | 1k 1% 0.4W |
| 3618 | 4822 051 10102 | 1k 2% 0.25W |
| 3619 | 4822 051 20562 | 5k6 5% 0.1W |
| 3620 | 4822 116 80176 | 1Ω 5% 0.5W |
| 3620 | 4822 116 80676 | 1Ω5 5% 0.5W |
| 3621 | 4822 116 80176 | 1Ω 5% 0.5W |
| 3622 | 4822 116 80176 | 1Ω 5% 0.5W |
| 3623 | 4822 117 10834 | 47k 1% 0.1W |
| 3624 | 4822 052 10158 | 1Ω5 5% 0.33W |
| 3625 | 4822 116 83872 | 220Ω 5% 0.5W |
| 3626 | 4822 116 83872 | 220Ω 5% 0.5W |
| 3627 | 4822 050 21003 | 10k 1% 0.6W |
| 3630 | 4822 051 10102 | 1k 2% 0.25W |
| 3631 | 4822 051 20332 | 3k3 5% 0.1W |
| 3632 | 4822 117 10833 | 10k 1% 0.1W |
| 3633 | 4822 050 21003 | 10k 1% 0.6W |
| 3644 | 4822 117 10833 | 10k 1% 0.1W |
| 3645 | 4822 116 52245 | 150k 5% 0.5W |
| 3652 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3701 | 4822 117 10833 | 10k 1% 0.1W |
| 3702 | 4822 117 10833 | 10k 1% 0.1W |
| 3730 | 4822 117 10833 | 10k 1% 0.1W |
| 3731 | 4822 117 10833 | 10k 1% 0.1W |
| 3732 | 4822 051 20822 | 8k2 5% 0.1W |
| 3733 | 4822 051 20822 | 8k2 5% 0.1W |
| 3734 | 4822 117 10834 | 47k 1% 0.1W |
| 3735 | 4822 117 10834 | 47k 1% 0.1W |
| 3736 | 4822 051 10102 | 1k 2% 0.25W |
| 3737 | 4822 051 10102 | 1k 2% 0.25W |
| 3738 | 4822 117 11148 | 56k 1% 0.1W |
| 3739 | 4822 117 11148 | 56k 1% 0.1W |
| 3740 | 4822 051 20683 | 68k 5% 0.1W |
| 3741 | 4822 051 20683 | 68k 5% 0.1W |
| 3742 | 4822 116 52199 | 68Ω 5% 0.5W |
| 3743 | 4822 116 52199 | 68Ω 5% 0.5W |
| 3756 | 4822 117 10833 | 10k 1% 0.1W |
| 3762 | 4822 051 20828 | 8Ω2 5% 0.1W |
| 3765 | 4822 117 11507 | 6k8 1% 0.1W |
| 3770 | 4822 117 10834 | 47k 1% 0.1W |
| 3771 | 4822 116 83933 | 15k 1% 0.1W |
| 3773 | 4822 116 83933 | 15k 1% 0.1W |
| 3789 | 4822 051 20828 | 8Ω2 5% 0.1W |
| 3790 | 4822 051 10102 | 1k 2% 0.25W |
| 3792 | 4822 051 10102 | 1k 2% 0.25W |
| 3900 | 4822 116 83868 | 150Ω 5% 0.5W |
| 3901 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3902 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3903 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3905 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3906 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3907 | 4822 051 20561 | 560Ω 5% 0.1W |
| 3908 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3909 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3910 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3911 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3913 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3915 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3916 | 4822 051 20822 | 8k2 5% 0.1W |
| 3918 | 4822 051 20392 | 3k9 5% 0.1W |
| 3919 | 4822 051 10102 | 1k 2% 0.25W |
| 3920 | 4822 051 10102 | 1k 2% 0.25W |
| 3921 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3922 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3923 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3924 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3925 | 4822 052 10688 | 6Ω8 5% 0.33W |
| 3928 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3929 | 4822 117 10833 | 10k 1% 0.1W |
| 3930 | 4822 051 20561 | 560Ω 5% 0.1W |
| 3932 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3935 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3936 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3937 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3940 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3941 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3942 | 4822 051 20822 | 8k2 5% 0.1W |
| 3944 | 4822 051 10102 | 1k 2% 0.25W |
| 3945 | 4822 051 20392 | 3k9 5% 0.1W |
| 3946 | 4822 051 10102 | 1k 2% 0.25W |
| 3970 | 4822 051 20471 | 470Ω 5% 0.1W |
| 3971 | 4822 117 10833 | 10k 1% 0.1W |
| 3972 | 4822 117 10833 | 10k 1% 0.1W |
| 3991 | 4822 116 52175 | 100Ω 5% 0.5W |
| 3992 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3993 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3994 | 4822 116 52175 | 100Ω 5% 0.5W |
| 3995 | 4822 116 52175 | 100Ω 5% 0.5W |
| 3996 | 4822 116 52175 | 100Ω 5% 0.5W |
| 3997 | 4822 116 52175 | 100Ω 5% 0.5W |
| 3998 | 4822 116 52175 | 100Ω 5% 0.5W |
| 4xxx | 4822 051 10008 | 0Ω 5% 0.25W |
| 4xxx | 4822 051 20008 | 0Ω 5% 0.25W |
| 9220 | 4822 051 20008 | JUMPER |
| 9225 | 4822 051 20008 | JUMPER |
| 9723 | 4822 051 20008 | JUMPER |
| 9724 | 4822 051 20008 | JUMPER |

| | | |
|---|---|---|
| 5101 | 4822 146 11065 | STANDBY TFM |
| 5102 | 4822 157 70436 | 8.2μH |
| 5103 | 4822 526 10704 | BEAD 50MHz |
| 5104 | 4822 157 11411 | BEAD 100MHz |
| 5105 | 4822 526 10704 | BEAD 100MHz |
| 5200 | 4822 157 11775 | 6.8μH 5% |
| 5400 | 4822 157 11869 | 33μH 10% |
| 5410 | 4822 146 11065 | TFM SIG FIX |
| 5411 | 4822 157 71097 | 0.56μH |
| 5421 | 4822 157 11204 | COIL LINE CORR.(29") |
| 5421 | 4822 157 11839 | COIL LINE CORR. (28") |
| 5421 | 4822 157 11841 | COIL LINE CORR. (28"WS,32"WS) |
| 5422 | 4822 157 71535 | COIL BRIDGE |
| 5424 | 4822 157 63255 | COIL BRIDGE |
| 5430 | 8204 000 73321 | LOT (29") |
| 5430 | 8228 001 33243 | LOT (25",28") |
| 5461 | 4822 157 11411 | BEAD 100MHz |
| 5463 | 4822 157 11411 | BEAD 100MHz |
| 5465 | 4822 157 11411 | BEAD 100MHz |
| 5466 | 4822 157 71467 | 39U 10% |
| 5467 | 4822 157 11411 | BEAD 100MHz |
| 5504 | 2422 549 43286 | MAINS 35mH 1A5 |
| 5505 | 4822 157 11411 | BEAD 100MHz |
| 5506 | 2422 531 98042 | TFM W8085-002 Y |
| 5510 | 4822 157 11411 | BEAD 100MHz |
| 5620 | 4822 157 11771 | 0.09μH 10% |

| | | |
|---|---|---|
| 6103 | 4822 130 42488 | BYD33D |
| 6105 | 4822 130 34281 | BZX79-B15 |
| 6106 | 4822 130 34499 | BZX79-B20 |
| 6108 | 4822 130 30621 | 1N4148 |
| 6109 | 4822 130 31083 | BYW55 |
| 6111 | 4822 130 32715 | SB340 |
| 6120 | 4822 130 30621 | 1N4148 |
| 6121 | 4822 130 30621 | 1N4148 |
| 6122 | 3198 010 53980 | BZX79-B3V9 |
| 6200 | 9322 149 10685 | BZM55-C33 |
| 6201 | 4822 130 83757 | BAS216 |
| 6202 | 4822 130 83757 | BAS216 |
| 6203 | 4822 130 10852 | BZX284-C6V8 |
| 6204 | 4822 130 10852 | BZX284-C6V8 |
| 6205 | 4822 130 83757 | BAS216 |
| 6405 | 4822 130 11027 | BZX284-C33 |
| 6406 | 4822 130 83757 | BAS216 |
| 6407 | 4822 130 83757 | BAS216 |
| 6408 | 4822 130 42488 | BYD33D |
| 6421 | 4822 130 10753 | BY359X-1500 |
| 6422 | 4822 130 10218 | BY229X-800 |
| 6442 | 9322 129 42685 | BZM55-C15 |
| 6461 | 4822 130 82512 | BYV29F-400 |
| 6462 | 4822 130 41487 | BYV95C |
| 6464 | 5322 130 31938 | BYV27-200 |
| 6468 | 4822 130 42488 | BYD33D |
| 6480 | 4822 130 42488 | BYD33D |
| 6481 | 4822 130 31024 | BZX79-B18 |
| 6482 | 4822 130 83757 | BAS216 |
| 6499 | 4822 130 83757 | BAS216 |
| 6501 | 4822 130 31083 | BYW55 |
| 6502 | 4822 130 31083 | BYW55 |
| 6503 | 4822 130 31083 | BYW55 |
| 6504 | 4822 130 31083 | BYW55 |
| 6505 | 4822 130 34281 | BZX79-B15 |
| 6506 | 4822 130 30621 | 1N4148 |
| 6507 | 4822 130 80791 | BYV28-200/20 |
| 6508 | 4822 130 11415 | BYV28-400/20 |
| 6510 | 4822 130 34281 | BZX79-B15 |
| 6511 | 4822 130 83757 | BAS216 |
| 6512 | 4822 130 83757 | BAS216 |
| 6514 | 5322 130 31932 | BZT03-C200 |
| 6515 | 4822 130 32904 | BZV85-C5V6 |
| 6516 | 4822 130 83757 | BAS216 |
| 6517 | 4822 130 31983 | BAT85 |
| 6518 | 4822 130 83757 | BAS216 |
| 6520 | 4822 130 42488 | BYD33D |
| 6521 | 4822 130 83757 | BAS216 |
| 6522 | 4822 130 83757 | BAS216 |
| 6600 | 4822 130 31983 | BAT85 |
| 6616 | 4822 130 83757 | BAS216 |
| 6619 | 4822 130 42488 | BYD33D |
| 6620 | 5322 130 31938 | BYV27-200 |
| 6621 | 4822 130 42488 | BYD33D |
| 6622 | 5322 130 33635 | BZV85-C8V2 |
| 6623 | 4822 130 83757 | BAS216 |

| | | |
|---|---|---|
| 7100 | 4822 130 44568 | BC557B |
| 7101 | 4822 130 40959 | BC547B |
| 7102 | 4822 130 11417 | STP3NB60FP |
| 7104 | 4822 130 11418 | TCDT1102G |
| 7407 | 4822 130 60511 | BC847B |
| 7408 | 9332 592 40126 | BC368 |
| 7409 | 4822 130 60511 | BC847B |
| 7421 | 4822 130 63666 | BU2520DF |
| 7480 | 4822 130 11417 | STP3NB60FP |
| 7481 | 4822 130 44568 | BC557B |
| 7482 | 4822 130 11418 | TCDT1102G |
| 7499 | 4822 130 60373 | BC856B |
| 7502 | 4822 130 61675 | BF487 |
| 7504 | 9322 126 65687 | STP5NB60FP |
| 7505 | 4822 130 60373 | BC856B |
| 7506 | 4822 209 81397 | TL431CLPST |
| 7510 | 4822 130 60511 | BC847B |
| 7511 | 4822 130 60373 | BC856B |
| 7528 | 4822 130 40981 | BC337-25 |
| 7529 | 4822 130 60511 | BC847B |
| 7600 | 4822 130 44461 | BC546B |
| 7602 | 4822 130 60511 | BC847B |
| 7603 | 4822 130 60373 | BC856B |
| 7605 | 4822 130 60511 | BC847B |
| 7606 | 4822 130 60511 | BC847B |
| 7610 | 4822 130 11418 | TCDT1102G |
| 7620 | 4822 209 90009 | TDA8177 |
| 7641 | 4822 130 60511 | BC847B |
| 7652 | 4822 130 60511 | BC847B |
| 7720 | 4822 130 60511 | BC847B |
| 7721 | 4822 130 60511 | BC847B |
| 7722 | 4822 130 60373 | BC856B |
| 7723 | 4822 130 60373 | BC856B |
| 7724 | 4822 130 60511 | BC847B |
| 7725 | 4822 130 60511 | BC847B |
| 7730 | 4822 130 60511 | BC847B |
| 7750 | 4822 209 32269 | TDA2616/N1 |
| 7900 | 4822 130 40959 | BC547B |
| 7901 | 4822 130 40959 | BC547B |
| 7905 | 9332 592 40126 | BC368 |
| 7906 | 4822 209 12334 | L4940V85 |
| 7907 | 4822 130 60511 | BC847B |

## Small Signal Panel [B]

### Various

| | | |
|---|---|---|
| 1001 | 2422 543 89022 | RES XTL 6M000 |
| 1301 | 2422 540 98456 | RES 12MHz |
| 1305 | 2422 543 01092 | RES XTL 4M433619 |
| 1308 | 2422 543 01097 | RES XTL 3M579545 |
| 1405 | 2422 549 44369 | FIL SAW 38MHz |
| 1407 | 2422 549 44324 | FIL TPWCC04BS |
| 1408 | 2422 549 44372 | FIL SAW 38MHz |
| 1409 | 2422 025 16542 | 2P MALE |
| 1651 | 2422 543 89019 | RES XTL 8M432 |
| 1701 | 2422 543 89018 | RES XTL 12MHz |

| | | |
|---|---|---|
| 2001 | 4822 126 11671 | 33pF |
| 2002 | 4822 126 11669 | 27pF |
| 2003 | 4822 126 13879 | 220nF 20% 16V |
| 2004 | 4822 126 13879 | 220nF 20% 16V |
| 2005 | 4822 126 14305 | 100nF 10% 16V |
| 2006 | 4822 126 14305 | 100nF 10% 16V |
| 2007 | 4822 126 14305 | 100nF 10% 16V |
| 2008 | 4822 126 14305 | 100nF 10% 16V |
| 2009 | 4822 122 33777 | 47pF 5% 63V |
| 2010 | 4822 122 33777 | 47pF 5% 63V |
| 2011 | 4822 122 33777 | 47pF 5% 63V |
| 2012 | 4822 122 33777 | 47pF 5% 63V |
| 2013 | 4822 124 12095 | 100µF 20% 16V |
| 2014 | 4822 126 14305 | 100nF 10% 16V |
| 2015 | 4822 126 14305 | 100nF 10% 16V |
| 2016 | 4822 124 12095 | 100µF 20% 16V |
| 2017 | 4822 126 14305 | 100nF 10% 16V |
| 2019 | 4822 126 14305 | 100nF 10% 16V |
| 2020 | 4822 126 13883 | 220pF 5% 50V |
| 2022 | 4822 126 14305 | 100nF 10% 16V |
| 2023 | 4822 126 14305 | 100nF 10% 16V |
| 2024 | 4822 126 14305 | 100nF 10% 16V |
| 2025 | 4822 126 14305 | 100nF 10% 16V |
| 2026 | 4822 126 14305 | 100nF 10% 16V |
| 2027 | 4822 126 14305 | 100nF 10% 16V |
| 2028 | 4822 126 14305 | 100nF 10% 16V |
| 2029 | 4822 126 14305 | 100nF 10% 16V |
| 2031 | 4822 126 14305 | 100nF 10% 16V |
| 2032 | 4822 126 14305 | 100nF 10% 16V |
| 2033 | 4822 126 14226 | 82pF 5% 50V |
| 2034 | 4822 126 14226 | 82pF 5% 50V |
| 2035 | 4822 126 14226 | 82pF 5% 50V |
| 2036 | 4822 126 14226 | 82pF 5% 50V |
| 2037 | 4822 126 14226 | 82pF 5% 50V |
| 2038 | 4822 126 14305 | 100nF 10% 16V |
| 2300 | 4822 124 12095 | 100µF 20% 16V |
| 2303 | 5322 126 11583 | 10nF 10% 50V |
| 2304 | 4822 122 33741 | 10pF 10% 50V |
| 2306 | 4822 126 13881 | 470pF 5% 50V |
| 2307 | 4822 126 14305 | 100nF 10% 16V |
| 2308 | 4822 122 33741 | 10pF 10% 50V |
| 2313 | 4822 121 70159 | 0.1µF 16V |
| 2314 | 4822 124 12095 | 100µF 20% 16V |
| 2315 | 4822 126 14305 | 100nF 10% 16V |
| 2317 | 4822 126 14491 | 2.2µF 10V |
| 2318 | 4822 126 14494 | 22nF 10% 25V |
| 2319 | 5322 126 11583 | 10nF 10% 50V |
| 2320 | 4822 122 33741 | 10pF 10% 50V |
| 2321 | 4822 126 14305 | 100nF 10% 16V |
| 2322 | 4822 126 14305 | 100nF 10% 16V |
| 2323 | 4822 126 14305 | 100nF 10% 16V |
| 2324 | 5322 126 11583 | 10nF 10% 50V |
| 2325 | 4822 126 14305 | 100nF 10% 16V |
| 2328 | 4822 122 33761 | 22pF 5% 50V |
| 2329 | 4822 126 14305 | 100nF 10% 16V |
| 2330 | 4822 126 14305 | 100nF 10% 16V |
| 2331 | 4822 126 14305 | 100nF 10% 16V |
| 2332 | 4822 126 14305 | 100nF 10% 16V |
| 2333 | 4822 126 14491 | 2.2µF 10V |
| 2334 | 4822 126 14491 | 2.2µF 10V |
| 2335 | 4822 124 80349 | 47µF 20% 6.3V |
| 2336 | 4822 126 14491 | 2.2µF 10V |
| 2338 | 5322 126 11583 | 10nF 10% 50V |
| 2340 | 4822 124 23002 | 10µF 16V |
| 2341 | 4822 124 12095 | 100µF 20% 16V |
| 2350 | 4822 126 14305 | 100nF 10% 16V |
| 2351 | 4822 126 14305 | 100nF 10% 16V |
| 2352 | 4822 126 14305 | 100nF 10% 16V |
| 2356 | 4822 126 14305 | 100nF 10% 16V |
| 2357 | 4822 126 14305 | 100nF 10% 16V |
| 2358 | 5322 126 11579 | 3.3nF 10% 63V |
| 2359 | 4822 122 33752 | 15pF 5% 50V |
| 2361 | 3198 016 31580 | 1P5 50V |
| 2362 | 4822 126 11663 | 12pF |
| 2365 | 4822 126 14305 | 100nF 10% 16V |
| 2366 | 4822 126 14305 | 100nF 10% 16V |
| 2367 | 4822 126 14305 | 100nF 10% 16V |
| 2368 | 4822 126 14305 | 100nF 10% 16V |
| 2369 | 4822 126 14305 | 100nF 10% 16V |
| 2370 | 4822 126 14305 | 100nF 10% 16V |
| 2371 | 4822 126 13193 | 4.7nF 10% 63V |
| 2372 | 4822 126 14043 | 1µF 20% 16V |
| 2373 | 4822 126 14305 | 100nF 10% 16V |
| 2374 | 4822 126 14491 | 2.2µF 10V |
| 2375 | 4822 126 14494 | 22nF 10% 25V |
| 2376 | 4822 126 14305 | 100nF 10% 16V |
| 2377 | 4822 124 12095 | 100µF 20% 16V |
| 2378 | 4822 126 14305 | 100nF 10% 16V |
| 2384 | 4822 126 14305 | 100nF 10% 16V |
| 2406 | 4822 126 13883 | 220pF 5% 50V |
| 2407 | 4822 126 13956 | 68pF 5% 63V |
| 2408 | 3198 016 32780 | 2P7 50V |
| 2409 | 4822 126 14491 | 2.2µF 10V |
| 2410 | 4822 126 14472 | 1µF 10% 10V |
| 2411 | 4822 126 14305 | 100nF 10% 16V |
| 2412 | 4822 126 13193 | 4.7nF 10% 63V |
| 2413 | 4822 124 80151 | 47µF 16V |
| 2417 | 3198 017 44740 | 470nF 10V |
| 2418 | 4822 126 13956 | 68pF 5% 63V |
| 2420 | 4822 122 33753 | 150pF 5% 50V |
| 2501 | 4822 122 33777 | 47pF 5% 63V |
| 2502 | 4822 122 32927 | 220nF 20% 50V |
| 2503 | 4822 122 32927 | 220nF 20% 50V |
| 2504 | 4822 122 32927 | 220nF 20% 50V |
| 2505 | 4822 122 32927 | 220nF 20% 50V |
| 2508 | 4822 124 12095 | 100µF 20% 16V |
| 2546 | 4822 124 23002 | 10µF 16V |
| 2547 | 4822 124 23002 | 10µF 16V |
| 2548 | 4822 124 23002 | 10µF 16V |
| 2549 | 4822 124 23002 | 10µF 16V |
| 2550 | 4822 126 14241 | 330P 50V |
| 2551 | 5322 126 11579 | 3.3nF 10% 63V |
| 2609 | 3198 016 31020 | 0603 25V 1nF |
| 2610 | 4822 126 14238 | 2N2 50V |
| 2611 | 5322 126 11578 | 1nF 10% 50V |
| 2629 | 4822 122 32927 | 220nF 20% 50V |
| 2636 | 4822 122 32927 | 220nF 20% 50V |
| 2637 | 4822 122 32927 | 220nF 20% 50V |
| 2638 | 4822 122 32927 | 220nF 20% 50V |
| 2640 | 4822 126 13879 | 220nF 20% 16V |
| 2641 | 4822 122 32927 | 220nF 20% 50V |
| 2642 | 4822 122 32927 | 220nF 20% 50V |
| 2651 | 4822 126 14305 | 100nF 10% 16V |
| 2652 | 4822 122 33777 | 47pF 5% 63V |
| 2653 | 4822 122 32927 | 220nF 20% 50V |
| 2654 | 4822 126 13881 | 470pF 5% 50V |
| 2655 | 4822 126 13881 | 470pF 5% 50V |
| 2656 | 4822 126 13881 | 470pF 5% 50V |
| 2657 | 4822 126 13881 | 470pF 5% 50V |
| 2658 | 4822 126 13881 | 470pF 5% 50V |
| 2661 | 4822 122 32927 | 220nF 20% 50V |
| 2662 | 4822 122 32927 | 220nF 20% 50V |
| 2663 | 4822 126 13881 | 470pF 5% 50V |
| 2664 | 4822 126 13881 | 470pF 5% 50V |
| 2665 | 4822 124 12095 | 100µF 20% 16V |
| 2666 | 4822 124 12095 | 100µF 20% 16V |
| 2667 | 3198 016 33380 | 3P3 50V |
| 2668 | 3198 016 33380 | 3P3 50V |
| 2669 | 4822 124 23002 | 10µF 16V |
| 2670 | 5322 126 11583 | 10nF 10% 50V |
| 2673 | 3198 016 31020 | 1nF 25V |
| 2674 | 3198 016 31020 | 1nF 25V |
| 2675 | 4822 124 23002 | 10µF 16V |
| 2677 | 3198 030 82280 | 2U2 20% 50V |
| 2677 | 4822 124 23002 | 10µF 16V |
| 2678 | 4822 124 23002 | 10µF 16V |
| 2679 | 4822 126 14305 | 100nF 10% 16V |
| 2680 | 4822 124 23002 | 10µF 16V |
| 2681 | 4822 126 14305 | 100nF 10% 16V |
| 2682 | 4822 124 23002 | 10µF 16V |
| 2685 | 3198 016 31020 | 1nF 25V |
| 2686 | 3198 016 31020 | 1nF 25V |
| 2690 | 4822 126 14305 | 100nF 10% 16V |
| 2691 | 4822 126 14305 | 100nF 10% 16V |
| 2692 | 4822 126 14305 | 100nF 10% 16V |
| 2693 | 4822 126 13883 | 220pF 5% 50V |
| 2702 | 4822 124 23002 | 10µF 16V |
| 2703 | 4822 126 14305 | 100nF 10% 16V |
| 2704 | 4822 124 23002 | 10µF 16V |
| 2706 | 4822 124 12095 | 100µF 20% 16V |
| 2707 | 4822 126 14305 | 100nF 10% 16V |
| 2708 | 4822 124 23002 | 10µF 16V |
| 2709 | 4822 126 14305 | 100nF 10% 16V |
| 2710 | 4822 124 23002 | 10µF 16V |
| 2712 | 4822 124 23002 | 10µF 16V |
| 2713 | 4822 126 14305 | 100nF 10% 16V |
| 2717 | 4822 126 14218 | 3.9pF 50V |
| 2718 | 4822 126 11669 | 27pF |
| 2719 | 4822 126 11663 | 12pF |
| 2720 | 4822 126 14218 | 3.9pF 50V |
| 2721 | 4822 126 11669 | 27pF |
| 2723 | 4822 126 11663 | 12pF |
| 2724 | 4822 126 14218 | 3.9pF 50V |
| 2725 | 4822 126 11669 | 27pF |
| 2726 | 4822 126 11663 | 12pF |
| 2728 | 4822 126 14305 | 100nF 10% 16V |
| 2729 | 4822 126 14225 | 56pF 5% 50V |
| 2730 | 4822 126 14494 | 22nF 10% 25V |
| 2731 | 4822 122 31765 | 100pF 2% 63V |
| 2733 | 4822 126 14494 | 22nF 10% 25V |
| 2738 | 4822 126 14494 | 22nF 10% 25V |
| 2743 | 4822 126 14494 | 22nF 10% 25V |
| 2747 | 4822 126 14507 | 18pF 5% 50V |
| 2748 | 4822 126 14507 | 18pF 5% 50V |
| 2755 | 4822 126 14305 | 100nF 10% 16V |
| 2756 | 4822 126 14305 | 100nF 10% 16V |
| 2757 | 4822 124 23002 | 10µF 16V |
| 2758 | 4822 126 14305 | 100nF 10% 16V |
| 2759 | 4822 126 14305 | 100nF 10% 16V |
| 2760 | 4822 126 14305 | 100nF 10% 16V |
| 2761 | 4822 126 14305 | 100nF 10% 16V |
| 2762 | 4822 126 14305 | 100nF 10% 16V |
| 2763 | 4822 126 14305 | 100nF 10% 16V |
| 2764 | 4822 126 14305 | 100nF 10% 16V |
| 2765 | 4822 126 14305 | 100nF 10% 16V |
| 2766 | 4822 126 14305 | 100nF 10% 16V |
| 2767 | 4822 126 14305 | 100nF 10% 16V |
| 2770 | 4822 126 14305 | 100nF 10% 16V |
| 2771 | 4822 126 14305 | 100nF 10% 16V |
| 2772 | 4822 126 14305 | 100nF 10% 16V |
| 2773 | 4822 126 14305 | 100nF 10% 16V |
| 2774 | 4822 126 14305 | 100nF 10% 16V |
| 2776 | 4822 126 14305 | 100nF 10% 16V |
| 2785 | 4822 126 14305 | 100nF 10% 16V |
| 2786 | 4822 126 14305 | 100nF 10% 16V |
| 2788 | 4822 126 14305 | 100nF 10% 16V |
| 2790 | 4822 126 14305 | 100nF 10% 16V |
| 2792 | 4822 126 14305 | 100nF 10% 16V |
| 2795 | 4822 126 14305 | 100nF 10% 16V |
| 2796 | 4822 126 14305 | 100nF 10% 16V |
| 2797 | 4822 126 13956 | 68pF 5% 63V |
| 2798 | 3198 016 36810 | 680P 25V |
| 2902 | 5322 126 11583 | 10nF 10% 50V |

| | | |
|---|---|---|
| 3001 | 4822 051 30472 | 4k7 5% 0.062W |
| 3002 | 4822 051 30472 | 4k7 5% 0.062W |
| 3003 | 4822 051 30223 | 22k 5% 0.062W |
| 3006 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3007 | 4822 117 13521 | 470Ω 5% 0.63W |
| 3008 | 4822 117 13526 | 150Ω 5% 0.63W |
| 3009 | 4822 051 30689 | 68Ω 5% 0.063W |
| 3011 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3012 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3013 | 4822 051 30103 | 10k 5% 0.062W |
| 3014 | 4822 051 30682 | 6k8 5% 0.062W |
| 3015 | 4822 051 30474 | 470k 5% 0.062W |
| 3016 | 4822 051 30152 | 1k5 5% 0.062W |
| 3017 | 4822 051 30472 | 4k7 5% 0.062W |
| 3018 | 4822 051 30103 | 10k 5% 0.062W |
| 3019 | 4822 051 30472 | 4k7 5% 0.062W |
| 3020 | 4822 051 30103 | 10k 5% 0.062W |
| 3021 | 4822 051 30103 | 10k 5% 0.062W |
| 3023 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3024 | 4822 051 30273 | 27k 5% 0.062W |
| 3025 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3026 | 4822 051 30103 | 10k 5% 0.062W |
| 3027 | 4822 117 12925 | 47k 1% 0.063W |
| 3028 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3029 | 4822 051 30103 | 10k 5% 0.062W |
| 3030 | 4822 051 30103 | 10k 5% 0.062W |
| 3031 | 4822 051 30103 | 10k 5% 0.062W |
| 3032 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3033 | 4822 051 30103 | 10k 5% 0.062W |
| 3034 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3035 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3039 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3040 | 4822 051 30103 | 10k 5% 0.062W |
| 3041 | 4822 051 30562 | 5k6 5% 0.063W |
| 3044 | 2120 108 92846 | 4k7 5% |
| 3058 | 4822 051 30682 | 6k8 5% 0.062W |
| 3059 | 2322 704 66201 | 620Ω 1% |
| 3060 | 4822 051 30103 | 10k 5% 0.062W |
| 3061 | 4822 051 30103 | 10k 5% 0.062W |
| 3062 | 4822 051 30103 | 10k 5% 0.062W |
| 3064 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3073 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3074 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3075 | 4822 051 30103 | 10k 5% 0.062W |
| 3076 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3077 | 4822 051 30272 | 2k7 5% 0.062W |
| 3078 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3079 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3080 | 4822 051 30103 | 10k 5% 0.062W |
| 3081 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3083 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3084 | 4822 051 30103 | 10k 5% 0.062W |
| 3085 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3086 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3087 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3088 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3090 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3091 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3092 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3300 | 2322 750 63908 | 3Ω9 5% |
| 3304 | 2322 750 63908 | 3Ω9 5% |

| | | |
|---|---|---|
| 3306 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3307 | 4822 051 30183 | 18k 5% 0.062W |
| 3308 | 4822 051 30684 | 680k 5% 0.062W |
| 3310 | 4822 117 12925 | 47k 1% 0.063W |
| 3311 | 4822 117 13632 | 100k 1% 0.62W |
| 3314 | 4822 051 30103 | 10k 5% 0.062W |
| 3315 | 4822 051 30102 | 1k 5% 0.062W |
| 3316 | 4822 051 30123 | 12k 5% 0.062W |
| 3317 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3318 | 4822 051 30102 | 1k 5% 0.062W |
| 3320 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3321 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3322 | 4822 051 10102 | 1k 2% 0.25W |
| 3324 | 4822 051 30222 | 2k2 5% 0.062W |
| 3327 | 4822 117 13632 | 100k 1% 0.62W |
| 3328 | 4822 051 30393 | 39k 5% 0.062W |
| 3329 | 4822 117 13568 | 6Ω8 5% |
| 3330 | 4822 051 30332 | 3k3 5% 0.062W |
| 3331 | 4822 051 30102 | 1k 5% 0.062W |
| 3333 | 4822 051 30102 | 1k 5% 0.062W |
| 3334 | 4822 051 30102 | 1k 5% 0.062W |
| 3335 | 4822 051 30332 | 3k3 5% 0.062W |
| 3336 | 4822 051 30102 | 1k 5% 0.062W |
| 3337 | 4822 117 12903 | 1k8 1% 0.063W |
| 3338 | 4822 051 30682 | 6k8 5% 0.062W |
| 3340 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3341 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3342 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3343 | 4822 051 30683 | 68k 5% 0.062W |
| 3344 | 4822 051 30222 | 2k2 5% 0.062W |
| 3345 | 4822 051 30103 | 10k 5% 0.062W |
| 3346 | 4822 051 30333 | 33k 5% 0.062W |
| 3347 | 4822 051 30223 | 22k 5% 0.062W |
| 3348 | 4822 051 30222 | 2k2 5% 0.062W |
| 3362 | 4822 051 30103 | 10k 5% 0.062W |
| 3363 | 4822 051 30102 | 1k 5% 0.062W |
| 3364 | 4822 051 30683 | 68k 5% 0.062W |
| 3365 | 4822 051 30472 | 4k7 5% 0.062W |
| 3366 | 4822 051 30102 | 1k 5% 0.062W |
| 3367 | 4822 051 30102 | 1k 5% 0.062W |
| 3370 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3371 | 4822 051 30479 | 47Ω 5% 0.062W |
| 3372 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3376 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3377 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3378 | 4822 051 30153 | 15k 5% 0.062W |
| 3382 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3384 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3385 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3386 | 4822 051 30223 | 22k 5% 0.062W |
| 3388 | 4822 051 30102 | 1k 5% 0.062W |
| 3389 | 4822 117 12925 | 47k 1% 0.063W |
| 3390 | 4822 051 30153 | 15k 5% 0.062W |
| 3391 | 4822 051 30683 | 68k 5% 0.062W |
| 3393 | 4822 117 13632 | 100k 1% 0.62W |
| 3394 | 4822 051 30472 | 4k7 5% 0.062W |
| 3400 | 4822 117 11152 | 4Ω7 5% |
| 3406 | 4822 051 30479 | 47Ω 5% 0.062W |
| 3411 | 4822 051 30472 | 4k7 5% 0.062W |
| 3414 | 4822 051 30472 | 4k7 5% 0.062W |
| 3415 | 4822 117 12902 | 8k2 1% 0.063W |
| 3416 | 4822 117 13568 | 6Ω8 5% |
| 3418 | 4822 051 30391 | 390Ω 5% 0.062W |
| 3419 | 4822 051 30759 | 75Ω 5% 0.062W |
| 3435 | 4822 051 30472 | 4k7 5% 0.062W |
| 3436 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3437 | 4822 051 30102 | 1k 5% 0.062W |
| 3439 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3441 | 4822 051 30393 | 39k 5% 0.062W |
| 3445 | 4822 051 30471 | 470Ω 5% 0.062W |
| 3446 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3532 | 4822 051 30102 | 1k 5% 0.062W |
| 3533 | 4822 051 30103 | 10k 5% 0.062W |
| 3540 | 4822 051 30103 | 10k 5% 0.062W |
| 3550 | 4822 051 30102 | 1k 5% 0.062W |
| 3551 | 4822 051 30102 | 1k 5% 0.062W |
| 3552 | 4822 051 30472 | 4k7 5% 0.062W |
| 3610 | 4822 117 12925 | 47k 1% 0.063W |
| 3611 | 4822 117 12925 | 47k 1% 0.063W |
| 3612 | 4822 117 12925 | 47k 1% 0.063W |
| 3613 | 4822 117 12925 | 47k 1% 0.063W |
| 3614 | 4822 117 12925 | 47k 1% 0.063W |
| 3615 | 4822 117 12925 | 47k 1% 0.063W |
| 3616 | 4822 051 30682 | 6k8 5% 0.062W |
| 3617 | 4822 051 30682 | 6k8 5% 0.062W |
| 3621 | 4822 051 30105 | 1M 5% 0.062W |
| 3636 | 4822 051 30105 | 1M 5% 0.062W |
| 3637 | 4822 051 30105 | 1M 5% 0.062W |
| 3638 | 4822 051 30105 | 1M 5% 0.062W |
| 3642 | 4822 051 30105 | 1M 5% 0.062W |
| 3644 | 4822 051 30105 | 1M 5% 0.062W |
| 3653 | 3198 021 90030 | JUMPER |
| 3654 | 3198 021 90030 | JUMPER |
| 3655 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3656 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3657 | 4822 051 30334 | 330k 5% 0.062W |
| 3658 | 4822 051 30334 | 330k 5% 0.062W |
| 3659 | 4822 051 30334 | 330k 5% 0.062W |
| 3660 | 4822 051 30334 | 330k 5% 0.062W |
| 3661 | 4822 117 11817 | 1k2 1% 1/16W |
| 3662 | 4822 117 11817 | 1k2 1% 1/16W |
| 3663 | 4822 117 11817 | 1k2 1% 1/16W |
| 3665 | 4822 051 30272 | 2k7 5% 0.062W |
| 3673 | 4822 051 30472 | 4k7 5% 0.062W |
| 3676 | 4822 117 11817 | 1k2 1% 1/16W |
| 3677 | 4822 051 30334 | 330k 5% 0.062W |
| 3678 | 4822 117 11817 | 1k2 1% 1/16W |
| 3679 | 4822 051 30334 | 330k 5% 0.062W |
| 3680 | 4822 117 11817 | 1k2 1% 1/16W |
| 3683 | 4822 051 30272 | 2k7 5% 0.062W |
| 3684 | 3198 021 90030 | JUMPER |
| 3685 | 3198 021 90030 | JUMPER |
| 3688 | 3198 021 90030 | JUMPER |
| 3689 | 3198 021 90030 | JUMPER |
| 3702 | 4822 117 12139 | 22Ω 5% 0.062W |
| 3703 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3705 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3706 | 4822 051 30109 | 10Ω 5% 0.062W |
| 3707 | 4822 051 30392 | 3k9 5% 0.063W |
| 3708 | 4822 051 30272 | 2k7 5% 0.062W |
| 3709 | 3198 021 90030 | JUMPER |
| 3710 | 4822 051 30391 | 390Ω 5% 0.062W |
| 3711 | 4822 051 30102 | 1k 5% 0.062W |
| 3712 | 4822 051 30391 | 390Ω 5% 0.062W |
| 3713 | 4822 051 30391 | 390Ω 5% 0.062W |
| 3714 | 4822 117 12139 | 22Ω 5% 0.062W |
| 3716 | 4822 051 30472 | 4k7 5% 0.062W |
| 3717 | 4822 051 30472 | 4k7 5% 0.062W |
| 3718 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3719 | 4822 117 13574 | 1Ω5 5% 1206 |
| 3720 | 4822 117 13574 | 1Ω5 5% 1206 |
| 3721 | 4822 117 13572 | 22Ω 5% 1206 |
| 3722 | 4822 117 13572 | 22Ω 5% 1206 |
| 3725 | 4822 051 30105 | 1M 5% 0.062W |
| 3728 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3731 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3732 | 4822 051 10102 | 1k 2% 0.25W |
| 3733 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3739 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3740 | 3198 021 90030 | JUMPER |
| 3741 | 4822 051 30102 | 1k 5% 0.062W |
| 3744 | 4822 051 30102 | 1k 5% 0.062W |
| 3745 | 4822 051 30102 | 1k 5% 0.062W |
| 3746 | 4822 051 30472 | 4k7 5% 0.062W |
| 3747 | 4822 051 30689 | 68Ω 5% |
| 3748 | 4822 051 30689 | 68Ω 5% |
| 3749 | 4822 051 30689 | 68Ω 5% 0.063W |
| 3754 | 4822 051 30109 | 10Ω 5% 0.062W |
| 3755 | 3198 021 90030 | JUMPER |
| 3757 | 3198 021 90030 | JUMPER |
| 3759 | 3198 021 90030 | JUMPER |
| 3790 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3791 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3792 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3793 | 4822 117 12662 | 10Ω 5% |
| 3793 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3794 | 4822 117 12662 | 10Ω 5% |
| 3794 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3795 | 4822 117 12662 | 10Ω 5% |
| 3795 | 4822 117 13522 | 100Ω 5% 0.63W |
| 3796 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3796 | 4822 051 30109 | 10Ω 5% 0.062W |
| 3797 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3900 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3901 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3903 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3905 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3906 | 4822 051 30101 | 100Ω 5% 0.062W |
| 3907 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3909 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3910 | 4822 051 30221 | 220Ω 5% 0.062W |
| 3911 | 4822 051 30101 | 100Ω 5% 0.062W |

| | | |
|---|---|---|
| 5301 | 4822 157 11876 | 6.8μH 10% |
| 5302 | 4822 157 11876 | 6.8μH 10% |
| 5403 | 2422 549 44461 | IND VAR 40mH |
| 5404 | 2422 535 95427 | 100mH |
| 5405 | 2422 535 95427 | IND FXD 100mHz 120R |
| 5406 | 3198 018 33980 | 3U9 10% |
| 5407 | 3198 018 56880 | 6U8 10% |
| 5408 | 2422 549 44459 | IND VAR 78mH |
| 5409 | 3198 018 51080 | 1U 10% |
| 5410 | 3198 018 33370 | 0U33 10% |
| 5651 | 2422 549 43769 | 100mH |
| 5652 | 2422 549 43769 | 100mH |
| 5653 | 2422 549 43769 | 100mH |
| 5654 | 4822 157 11716 | BLM21P300SPT |
| 5701 | 4822 157 71206 | BLM21A601SPT |
| 5702 | 2422 535 95427 | 100mH |
| 5703 | 4822 157 11716 | BLM21P300SPT |
| 5704 | 4822 157 11716 | BLM21P300SPT |
| 5705 | 2422 535 95427 | 100mH |
| 5706 | 4822 157 11778 | 5U6 10% |
| 5707 | 4822 157 11781 | BLM11A601SPT1 |
| 5708 | 4822 157 11778 | 5U6 10% |
| 5709 | 4822 157 11778 | 5U6 10% |
| 5710 | 4822 157 11778 | 5U6 10% |
| 5711 | 4822 157 11781 | BLM11A601SPT1 |
| 5713 | 4822 157 11781 | BLM11A601SPT1 |
| 5718 | 3198 018 33370 | 0U33 10% |
| 5720 | 4822 157 11781 | BLM11A601SPT1 |
| 5910 | 4822 157 11781 | BLM11A601SPT1 |

| | | |
|---|---|---|
| 6001 | 4822 130 11528 | 1PS76SB10 |
| 6003 | 4822 130 11528 | 1PS76SB10 |
| 6303 | 4822 130 11594 | BZX284-C47 |
| 6304 | 4822 130 83757 | BAS216 |
| 6306 | 9322 129 37685 | BZM55-C5V6 |
| 6307 | 4822 130 11528 | 1PS76SB10 |
| 6309 | 4822 130 83757 | BAS216 |
| 6310 | 9322 129 38685 | BZM55-C6V8 |
| 6311 | 9322 149 08685 | BZM55-C22 |
| 6319 | 4822 130 83757 | BAS216 |
| 6334 | 4822 130 83757 | BAS216 |
| 6403 | 4822 130 10414 | BA792 |
| 6652 | 9322 129 40685 | BZM55-C10 |
| 6653 | 4822 130 83757 | BAS216 |

| | | |
|---|---|---|
| 7001 | 9352 629 88557 | SAA5801/011 V30 |
| 7002 | 5322 130 42756 | BC857C |
| 7003 | 3198 010 42310 | BC847BW |
| 7004 | 3198 010 42310 | BC847BW |
| 7005 | 9322 116 74668 | LD1117D33 |
| 7006 | 3104 317 42211 | SOFTW.ASSY 310431702211 |
| 7007 | 9322 136 53668 | MSM51V18165D-60JS |
| 7008 | 3198 010 42310 | BC847BW |
| 7009 | 3198 010 42310 | BC847BW |
| 7010 | 5322 130 42756 | BC857C |
| 7011 | 4822 209 17377 | M24C32-WMN6/PROG |
| 7301 | 9352 625 23518 | TDA9330H/N2 |
| 7303 | 5322 130 42756 | BC857C |
| 7308 | 9340 310 30215 | PDTC144ET |
| 7309 | 9340 310 30215 | PDTC144ET |
| 7310 | 9340 310 30215 | PDTC144ET |
| 7311 | 3198 010 42310 | BC847BW |
| 7312 | 3198 010 42310 | BC847BW |
| 7320 | 3198 010 42310 | BC847BW |
| 7322 | 3198 010 42310 | BC847BW |
| 7323 | 9352 625 24518 | TDA9321H/N2 |
| 7324 | 5322 130 63679 | BC847CW |
| 7403 | 4822 130 60511 | BC847B |
| 7407 | 4822 130 60373 | BC856B |
| 7411 | 4822 130 60511 | BC847B |
| 7651 | 9322 143 53671 | MSP3415D-FH-B3 |
| 7651 | 9322 149 63671 | MSP3451G-FH-A1 |
| 7652 | 9351 874 90118 | 74HC4052PW |
| 7656 | 9340 425 20115 | BC847BS |
| 7658 | 9340 425 20115 | BC847BS |
| 7663 | 9340 425 20115 | BC847BS |
| 7674 | 3198 010 42310 | BC847BW |
| 7675 | 9351 874 90118 | 74HC4052PW |
| 7680 | 3198 010 42310 | BC847BW |
| 7681 | 3198 010 42310 | BC847BW |
| 7701 | 5322 130 42756 | BC857C |
| 7702 | 3198 010 42310 | BC847BW |
| 7704 | 4822 209 73852 | PMBT2369 |
| 7708 | 4822 209 90034 | SAA4990H/V0 |
| 7709 | 9352 640 20557 | SAA4978H/V203 |
| 7713 | 9322 116 74668 | LD1117D33 |
| 7714 | 4822 209 17307 | MSM54V12222A-30JS |
| 7715 | 4822 209 17307 | MSM54V12222A-30JS |
| 7716 | 2422 486 80737 | IC SOCKET 32P |

## Main Switch Panel [E]

### Various

| | | |
|---|---|---|
| 0151 | 4822 256 91766 | LED HOLDER |
| 0201 | 2422 025 16268 | 2P MALE |
| 0202 | 2422 025 16374 | 2P MALE |
| 0923 | 2412 020 00724 | 2P MALE |

| | | |
|---|---|---|
| 0947 | 4822 267 10734 | 5P MALE |
| 1910 | 4822 130 91478 | IR RECEIVER |
| 1951 | 4822 276 14024 | 2P 4/128A |

| | | |
|---|---|---|
| 2930 | 4822 124 41584 | 100µF 20% 10V |

| | | |
|---|---|---|
| 3957 | 4822 053 21335 | 3M3 5% 0.5W |
| 3966 | 4822 053 21335 | 3M3 5% 0.5W |
| 3978 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3982 | 4822 117 13577 | 330Ω 1% 1.25W |

| | | |
|---|---|---|
| 6901 | 4822 130 10859 | TLDR5400 |

## CRT Panel [F]

### Various

| | | |
|---|---|---|
| 0298 | 2422 500 80052 | 9P FEMALE |
| 0340 | 3104 311 02321 | CABLE 11P 400mm |
| 0383 | 2422 025 16382 | 3P MALE |

| | | |
|---|---|---|
| 2300 | 4822 124 40764 | 22µF 100 V |
| 2301 | 4822 124 40196 | 220µF 20% 16V |
| 2302 | 5322 122 32286 | 3.3pF 5% 50V |
| 2303 | 5322 122 32268 | 470pF 10% 50V |
| 2304 | 4822 121 41856 | 22nF 5% 250V |
| 2305 | 4822 124 41751 | 47µF 20% 50V |
| 2306 | 4822 126 14585 | 100nF 10% 50V |
| 2307 | 5322 122 32654 | 22nF 10% 63V |
| 2308 | 4822 126 13486 | 15pF 2% 63V |
| 2309 | 5322 122 32654 | 22nF 10% 63V |
| 2310 | 4822 126 13689 | 18pF 1% 63V |
| 2312 | 5322 122 32658 | 22pF 5% 50V |
| 2313 | 4822 124 11565 | 10µF 20% 250V |
| 2316 | 4822 121 40518 | 100nF 10% 250V |
| 2317 | 5322 121 44356 | 4.7nF 5% 2KV |
| 2318 | 5322 122 32654 | 22nF 10% 63V |
| 2320 | 4822 126 13838 | 100nF 20% 50V |
| 2321 | 5322 122 32531 | 100pF 5% 50V |
| 2322 | 5322 122 32531 | 100pF 5% 50V |
| 2323 | 5322 122 32531 | 100pF 5% 50V |
| 2325 | 4822 126 14585 | 100nF 10% 50V |

| | | |
|---|---|---|
| 3300 | 4822 052 10109 | 10Ω 5% 0.33W |
| 3301 | 4822 053 12103 | 10k 5% 3W |
| 3302 | 4822 051 20182 | 1k8 5% 0.1W |
| 3303 | 4822 117 10965 | 18k 1% 0.1W |
| 3304 | 4822 117 11454 | 820Ω 1% 0.1W |
| 3305 | 4822 117 13577 | 330Ω 1% 1.25W |
| 3306 | 4822 051 20478 | 4Ω7 5% 0.1W |
| 3307 | 4822 051 20109 | 10Ω 5% 0.1W |
| 3308 | 4822 117 11148 | 56k 1% 0.1W |
| 3309 | 4822 117 10353 | 150Ω 1% 0.1W |
| 3310 | 4822 051 10102 | 1k 2% 0.25W |
| 3311 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3312 | 4822 117 11449 | 2k2 1% 0.1W |
| 3313 | 4822 116 83872 | 220Ω 5% 0.5W |
| 3314 | 4822 116 83872 | 220Ω 5% 0.5W |
| 3315 | 4822 117 11139 | 1k5 1% 0.1W |
| 3316 | 4822 117 11148 | 56k 1% 0.1W |
| 3317 | 4822 051 20122 | 1k2 5% 0.1W |
| 3318 | 4822 051 20159 | 15Ω 5% 0.1W |
| 3319 | 4822 117 11454 | 820Ω 1% 0.1W |
| 3320 | 4822 051 10102 | 1k 2% 0.25W |
| 3334 | 4822 050 11002 | 1k 1% 0.4W |
| 3335 | 4822 051 10102 | 1k 2% 0.25W |
| 3336 | 4822 051 10102 | 1k 2% 0.25W |
| 3337 | 4822 051 10102 | 1k 2% 0.25W |
| 3338 | 3198 013 01020 | 1k 2% 1/2W |
| 3339 | 3198 013 01020 | 1k 2% 1/2W |
| 3340 | 3198 013 01020 | 1k 2% 1/2W |
| 3341 | 4822 052 10151 | 150Ω 5% 0.33W |
| 3342 | 4822 051 20471 | 470Ω 5% 0.1W |
| 3344 | 4822 116 52191 | 33Ω 5% 0.5W |
| 3345 | 4822 116 52191 | 33Ω 5% 0.5W |
| 3347 | 3198 013 01520 | 1k5 2% 1/2W |
| 3348 | 4822 050 11204 | 120k 1% 0.4W |
| 3349 | 3198 013 01020 | 1k 2% 1/2W |
| 3350 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3351 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3352 | 4822 116 83883 | 470Ω 5% 0.5W |
| 3354 | 4822 117 11449 | 2k2 1% 0.1W |
| 3355 | 4822 051 20478 | 4Ω7 5% 0.1W |
| 3356 | 4822 051 10102 | 1k 2% 0.25W |
| 3357 | 4822 051 20478 | 4Ω7 5% 0.1W |
| 4xxx | 4822 051 10008 | 0Ω 5% 0.25W |
| 4xxx | 4822 051 20008 | 0Ω 5% 0.25W |

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|---|---|---|
| 5300 | 2422 531 98035 | TFM S13974-01 Y |

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|---|---|---|
| 6305 | 4822 130 30842 | BAV21 |
| 6306 | 4822 130 30842 | BAV21 |
| 6307 | 4822 130 30842 | BAV21 |
| 6310 | 4822 130 83757 | BAS216 |

| | | |
|---|---|---|
| 7300 | 4822 130 44154 | BF199 |
| 7301 | 4822 130 42589 | BF370 |
| 7302 | 5322 130 41888 | BD140-16 |
| 7303 | 5322 130 41886 | BD139-16 |
| 7307 | 9352 561 40112 | TDA6108 |
| 8317 | 3104 311 01901 | CABLE 2P 560mm |
| 8325 | 3104 311 01911 | CABLE 3P 680mm |

## Side I/O Panel [O]

### Various

| | | |
|---|---|---|
| 0900 | 2422 026 04926 | 4P FEMALE |
| 0901 | 4822 267 10975 | 3P |
| 0902 | 4822 267 31014 | HEADPHONE SOCKET |
| 0936 | 2422 025 12485 | 11P MALE |

| | | |
|---|---|---|
| 2905 | 4822 122 33177 | 10nF 20% 50V |
| 2906 | 4822 122 33177 | 10nF 20% 50V |

| | | |
|---|---|---|
| 3901 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3902 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3903 | 4822 051 20101 | 100Ω 5% 0.1W |
| 3904 | 4822 116 52201 | 75Ω 5% 0.5W |
| 3905 | 4822 050 11002 | 1k 1% 0.4W |
| 3906 | 4822 050 11002 | 1k 1% 0.4W |
| 3907 | 4822 117 10834 | 47k 1% 0.1W |
| 3908 | 4822 050 11002 | 1k 1% 0.4W |
| 3909 | 4822 117 10834 | 47k 1% 0.1W |
| 3910 | 4822 116 52276 | 3k9 5% 0.5W |
| 3911 | 4822 050 21003 | 10k 1% 0.6W |
| 3912 | 4822 050 21003 | 10k 1% 0.6W |

## Top Control Panel [P]

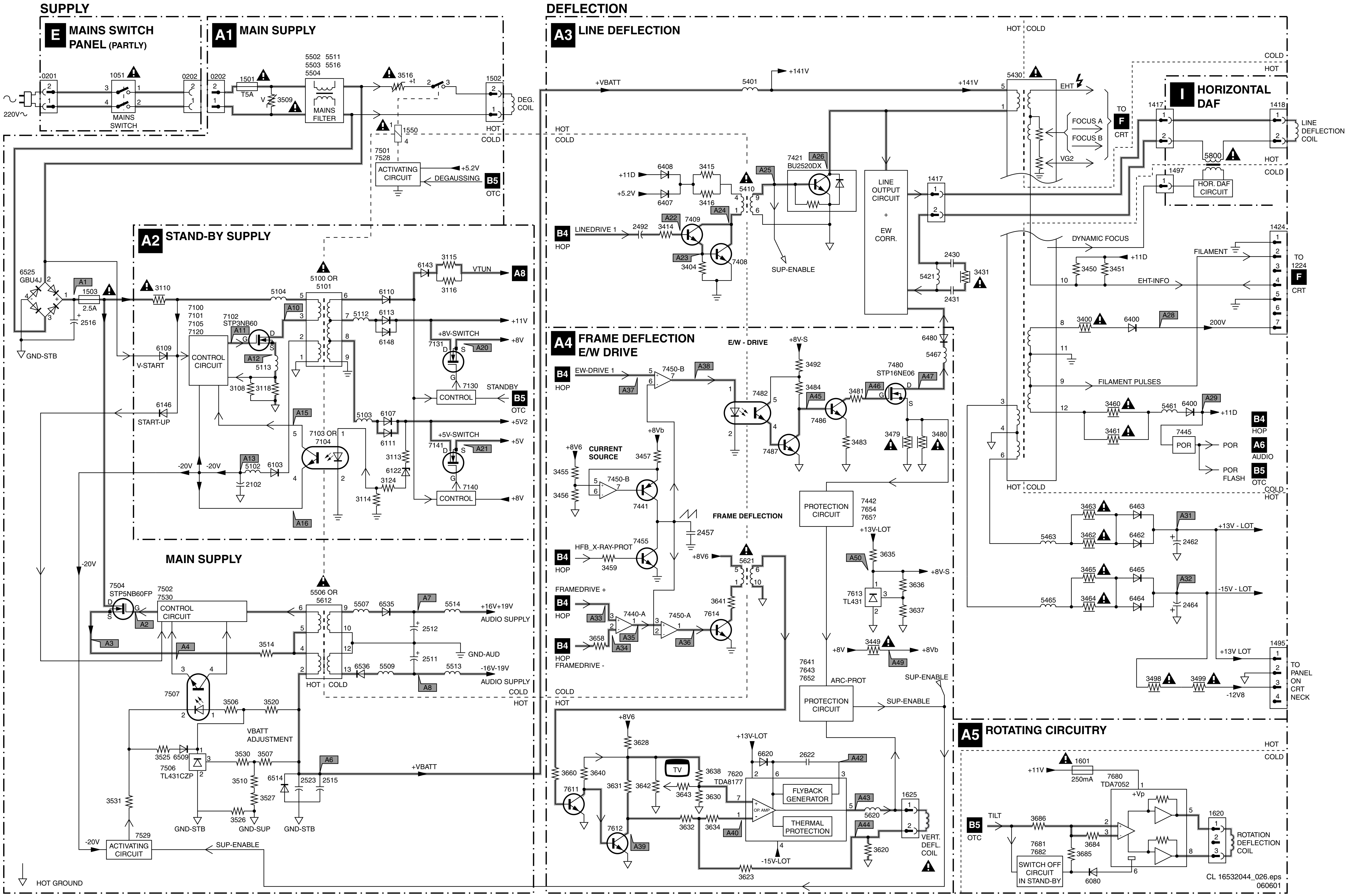
### Various

| | | |
|---|---|---|
| 0345 | 4822 267 10748 | 3P MALE |
| 1701 | 4822 276 13775 | SWITCH |
| 1702 | 4822 276 13775 | SWITCH |
| 1703 | 4822 276 13775 | SWITCH |
| 1704 | 4822 276 13775 | SWITCH |
| 1705 | 4822 276 13775 | SWITCH |

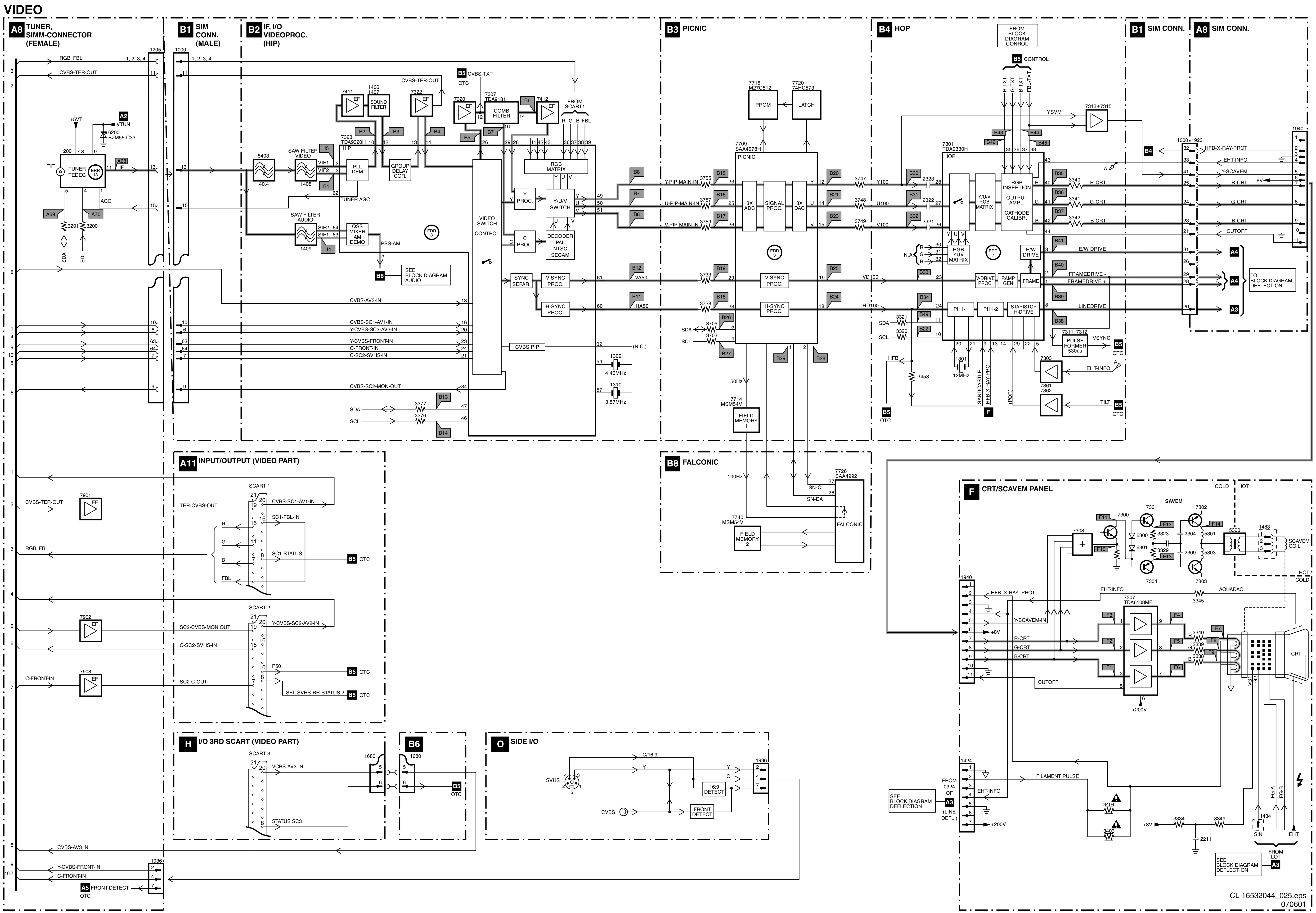
| | | |
|---|---|---|
| 3701 | 4822 051 20391 | 390Ω 5% 0.1W |
| 3702 | 4822 117 13528 | 200Ω 1% 0.125W |
| 3703 | 4822 117 10845 | 620Ω 1% 0.1W |
| 3704 | 4822 117 11534 | 1k1 1% 0.1W |
| 3705 | 4822 117 11951 | 2k 1% 0.1W |
| 3999 | 4822 051 10102 | 1k 2% 0.25W |

# 6. Block Diagrams, Wiring and Supply Diagram and Testpoints

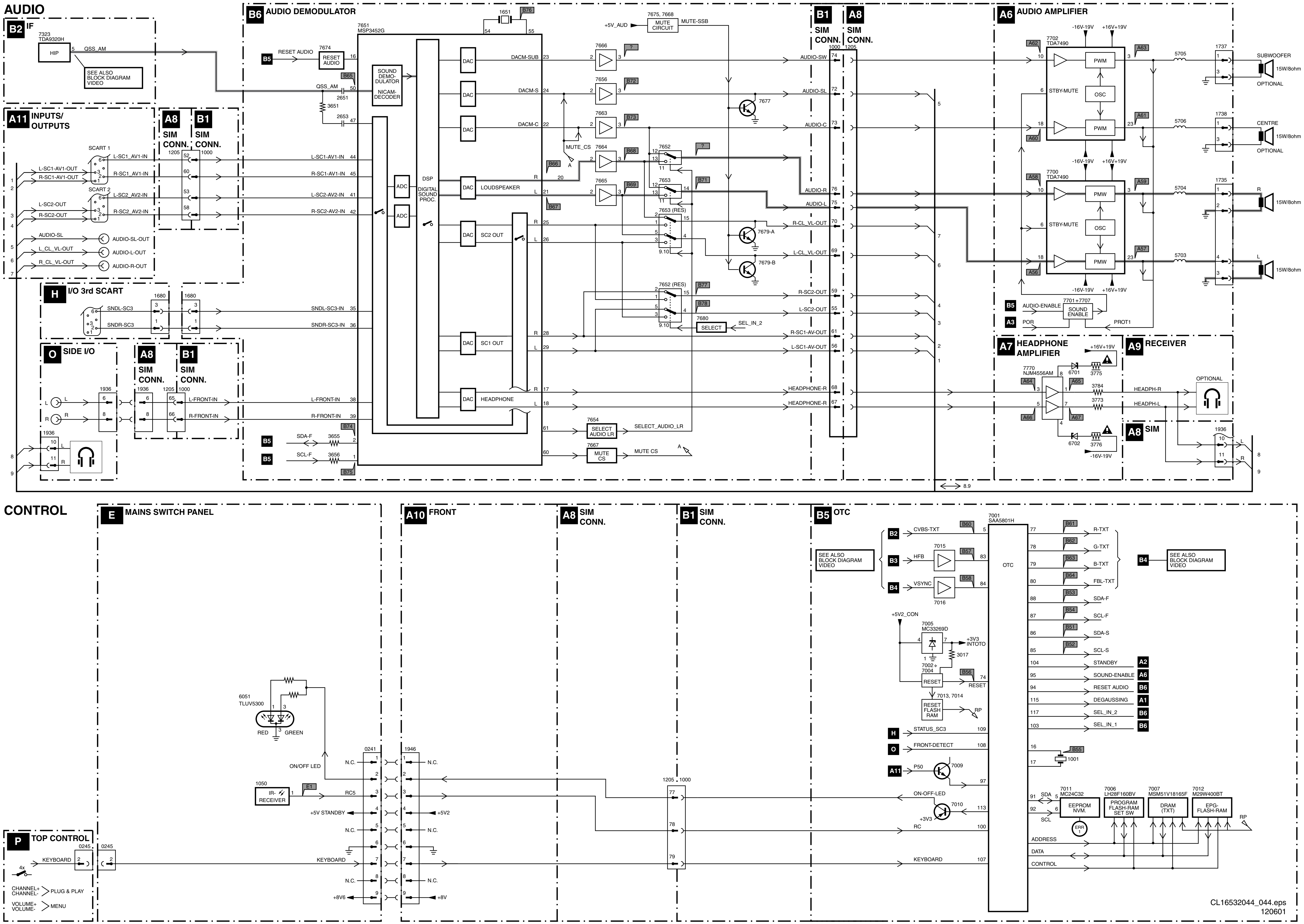
## Block Diagram LSP



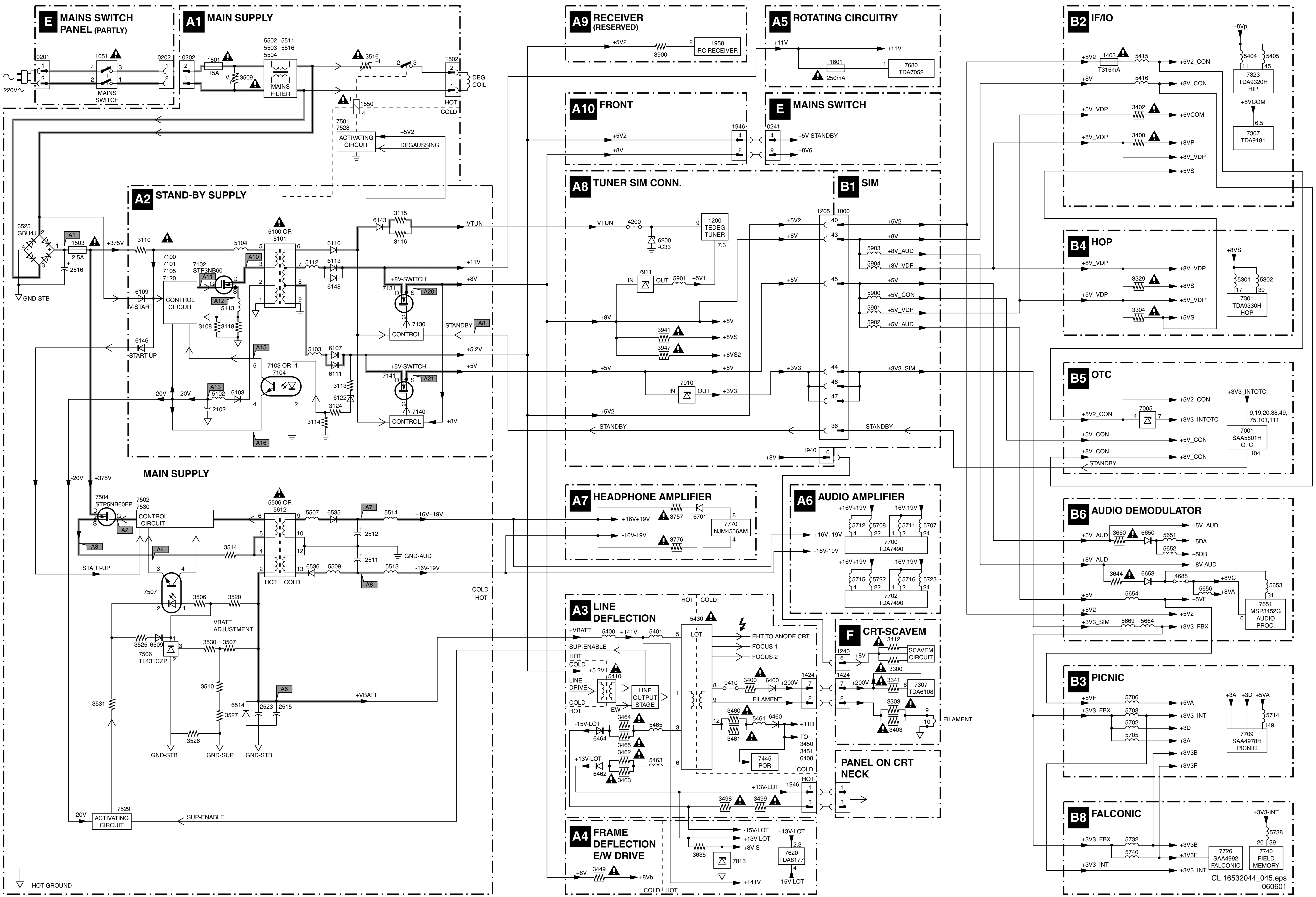
## Block Diagram SSB Video



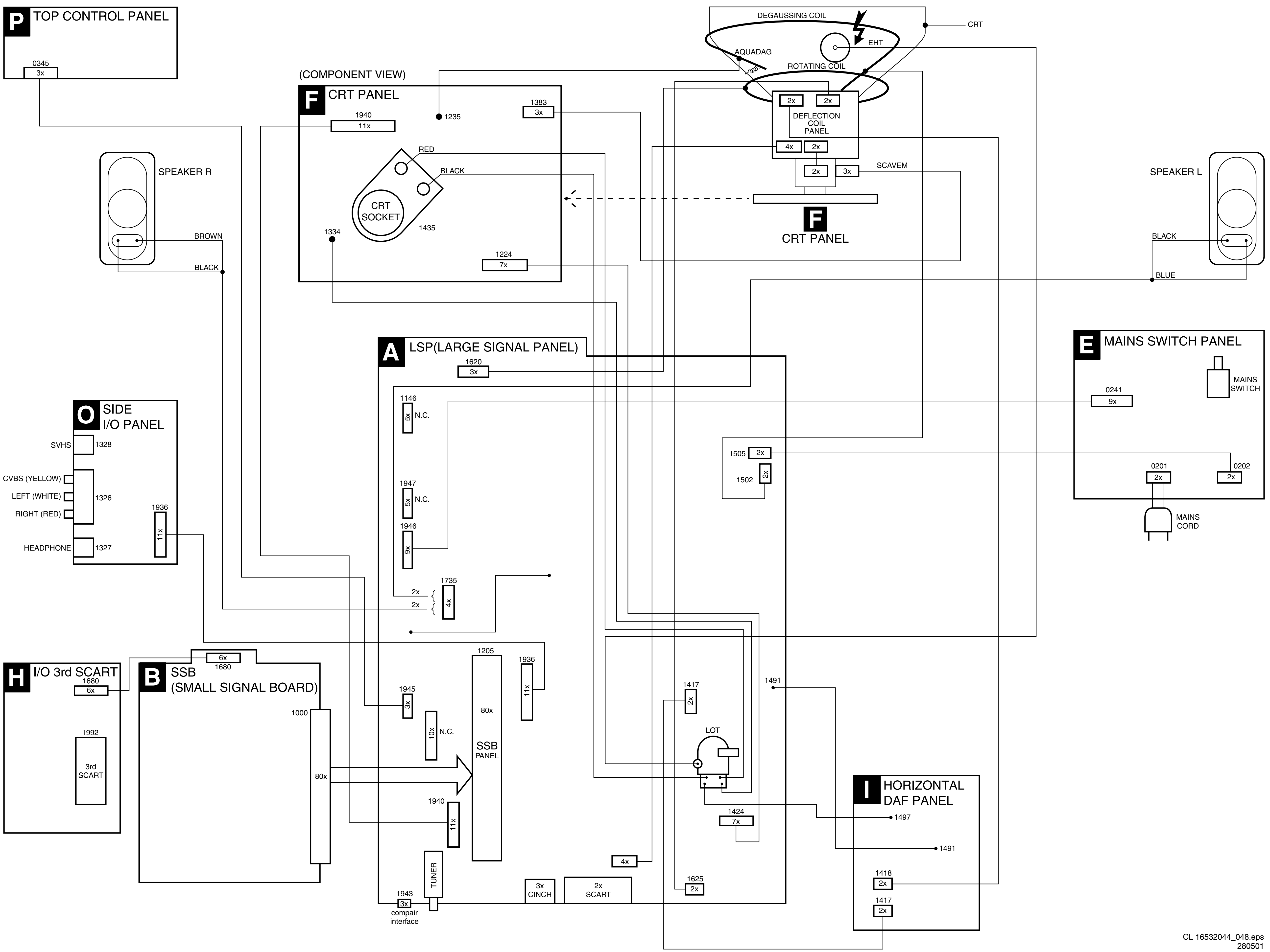
# Block Diagram SSB Audio



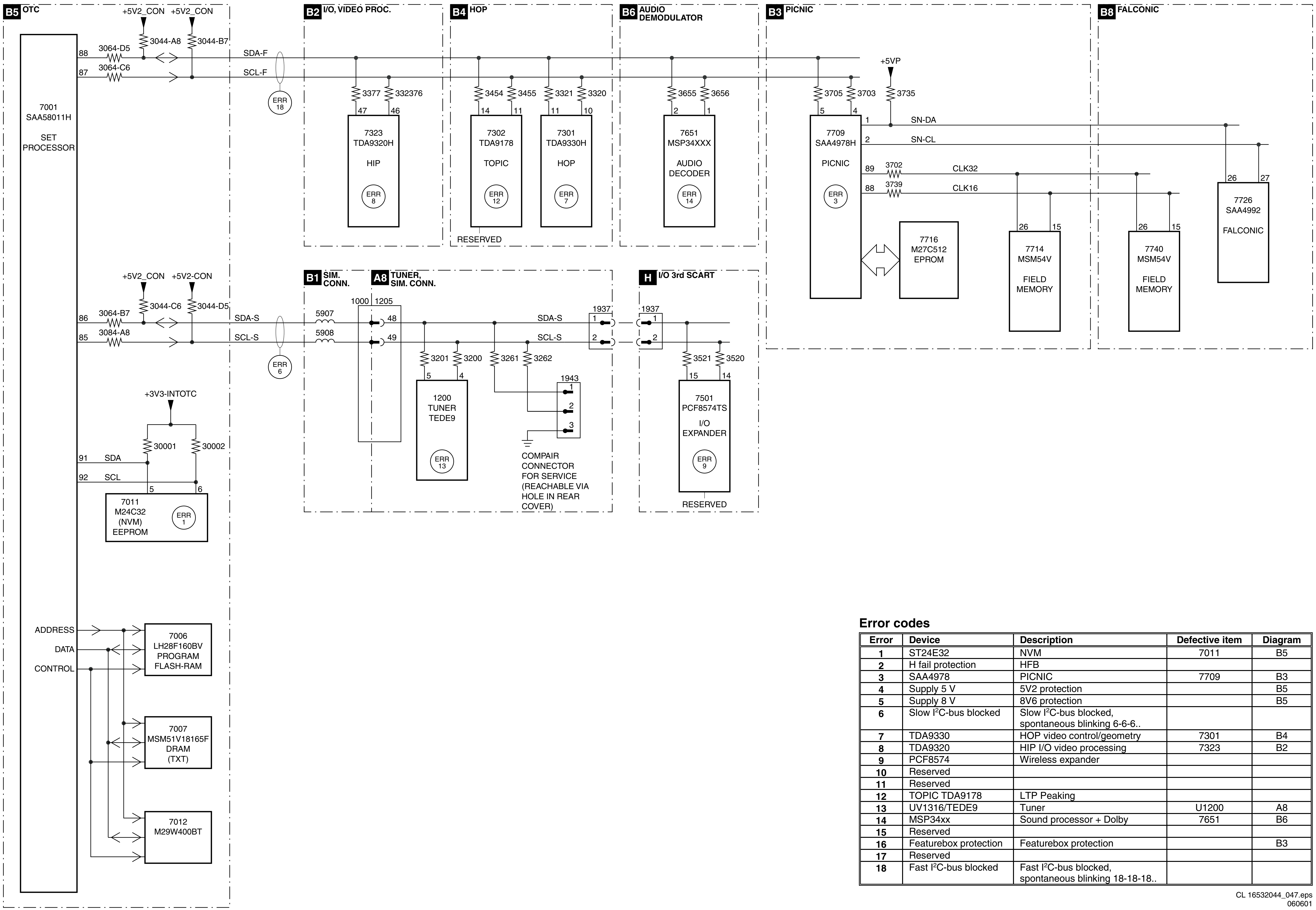
## Supply Lines Overview



## Wiring Diagram



## I²C Overview



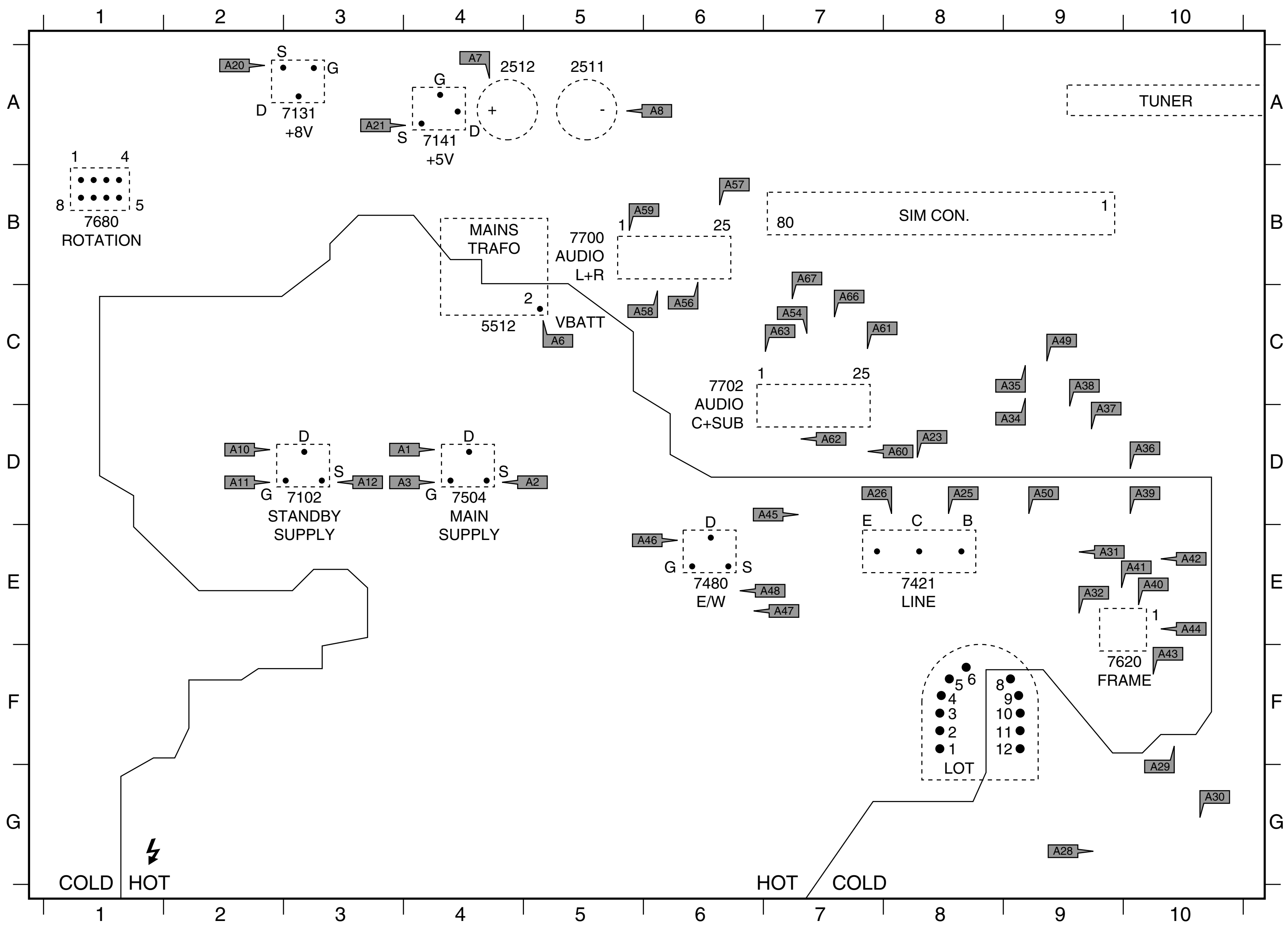

### Error codes

| Error | Device | Description | Defective item | Diagram |
|---|---|---|---|---|
| 1 | ST24E32 | NVM | 7011 | B5 |
| 2 | H fail protection | HFB | | |
| 3 | SAA4978 | PICNIC | 7709 | B3 |
| 4 | Supply 5 V | 5V2 protection | | B5 |
| 5 | Supply 8 V | 8V6 protection | | B5 |
| 6 | Slow I²C-bus blocked | Slow I²C-bus blocked, spontaneous blinking 6-6-6.. | | |
| 7 | TDA9330 | HOP video control/geometry | 7301 | B4 |
| 8 | TDA9320 | HIP I/O video processing | 7323 | B2 |
| 9 | PCF8574 | Wireless expander | | |
| 10 | Reserved | | | |
| 11 | Reserved | | | |
| 12 | TOPIC TDA9178 | LTP Peaking | | |
| 13 | UV1316/TEDE9 | Tuner | U1200 | A8 |
| 14 | MSP34xx | Sound processor + Dolby | 7651 | B6 |
| 15 | Reserved | | | |
| 16 | Featurebox protection | Featurebox protection | | B3 |
| 17 | Reserved | | | |
| 18 | Fast I²C-bus blocked | Fast I²C-bus blocked, spontaneous blinking 18-18-18.. | | |

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060601

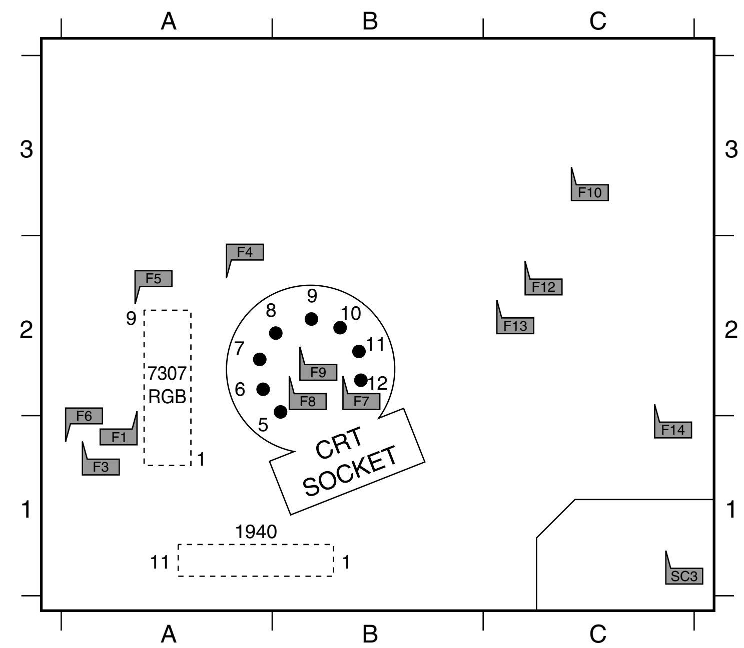
## Testpoint Overviews

### LSP COPPER TRACK SIDE

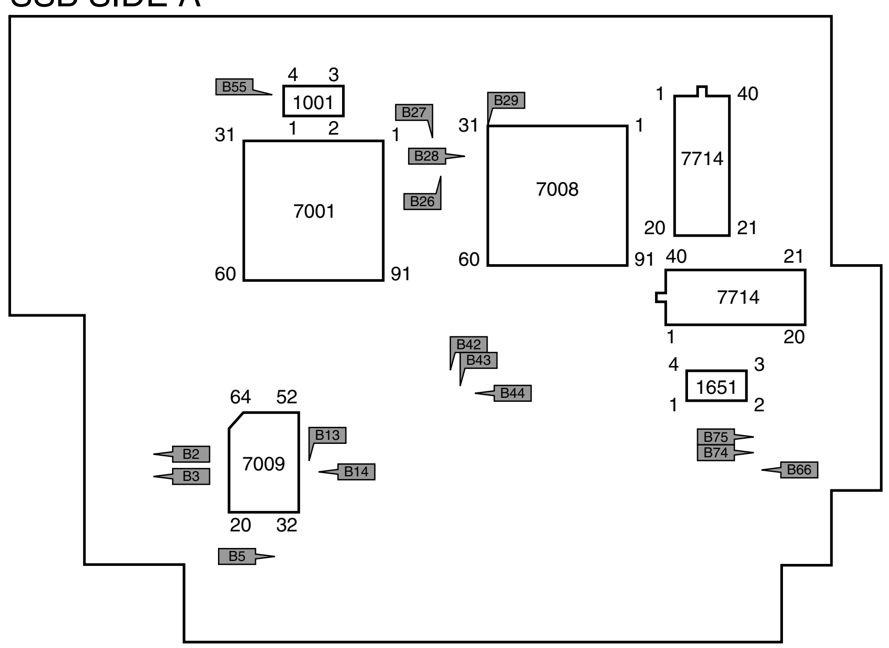



| | |
|---|---|
| A1 | D4 |
| A2 | D4 |
| A3 | D4 |
| A6 | C5 |
| A7 | A4 |
| A8 | A5 |
| A10 | D3 |
| A11 | D3 |
| A12 | D3 |
| A20 | A2 |
| A21 | A4 |
| A23 | D8 |
| A25 | D8 |
| A26 | D8 |
| A28 | G9 |
| A29 | F10 |
| A30 | G10 |
| A31 | E9 |
| A32 | E9 |
| A34 | D9 |
| A37 | D9 |
| A39 | D10 |
| A40 | E10 |
| A41 | E9 |
| A42 | E10 |
| A43 | F10 |
| A45 | D7 |
| A46 | E6 |
| A47 | E6 |
| A48 | E6 |
| A49 | C9 |
| A50 | B5 |
| A57 | D9 |
| A59 | C6 |
| A60 | D7 |
| A62 | D7 |

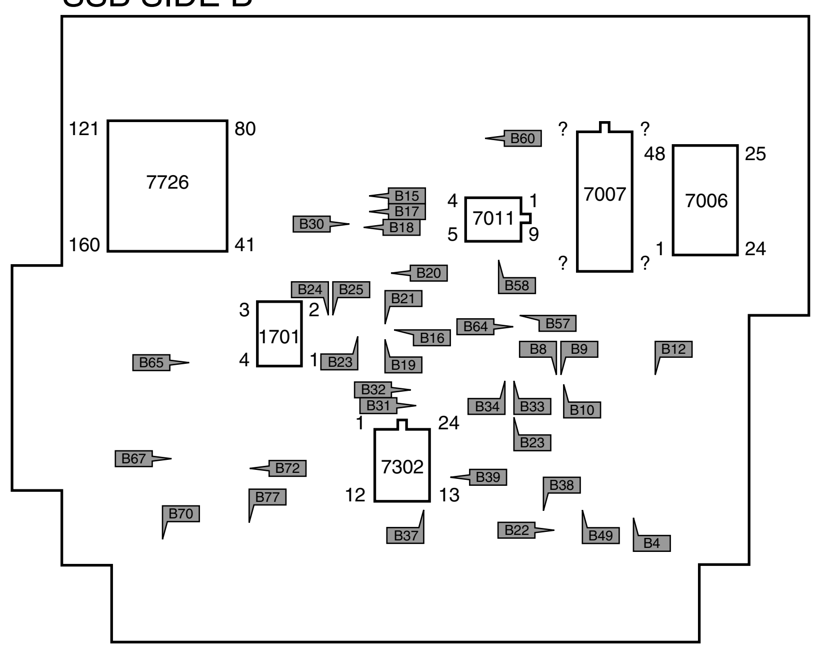
### CRT PANEL (COPPER TRACK SIDE)




### SSB SIDE A



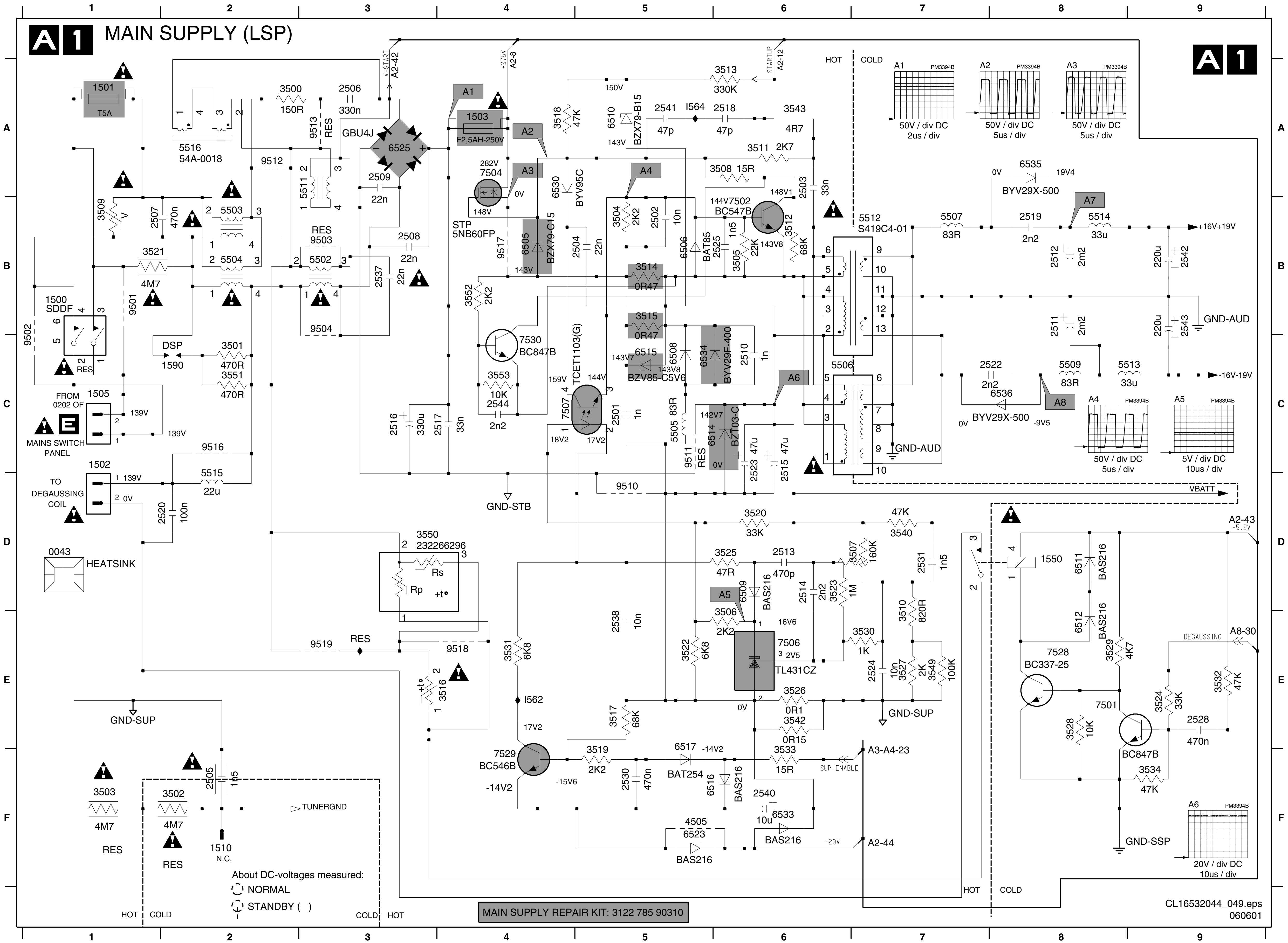

### SSB SIDE B




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060601

# 7. Electrical Diagrams and PWB's

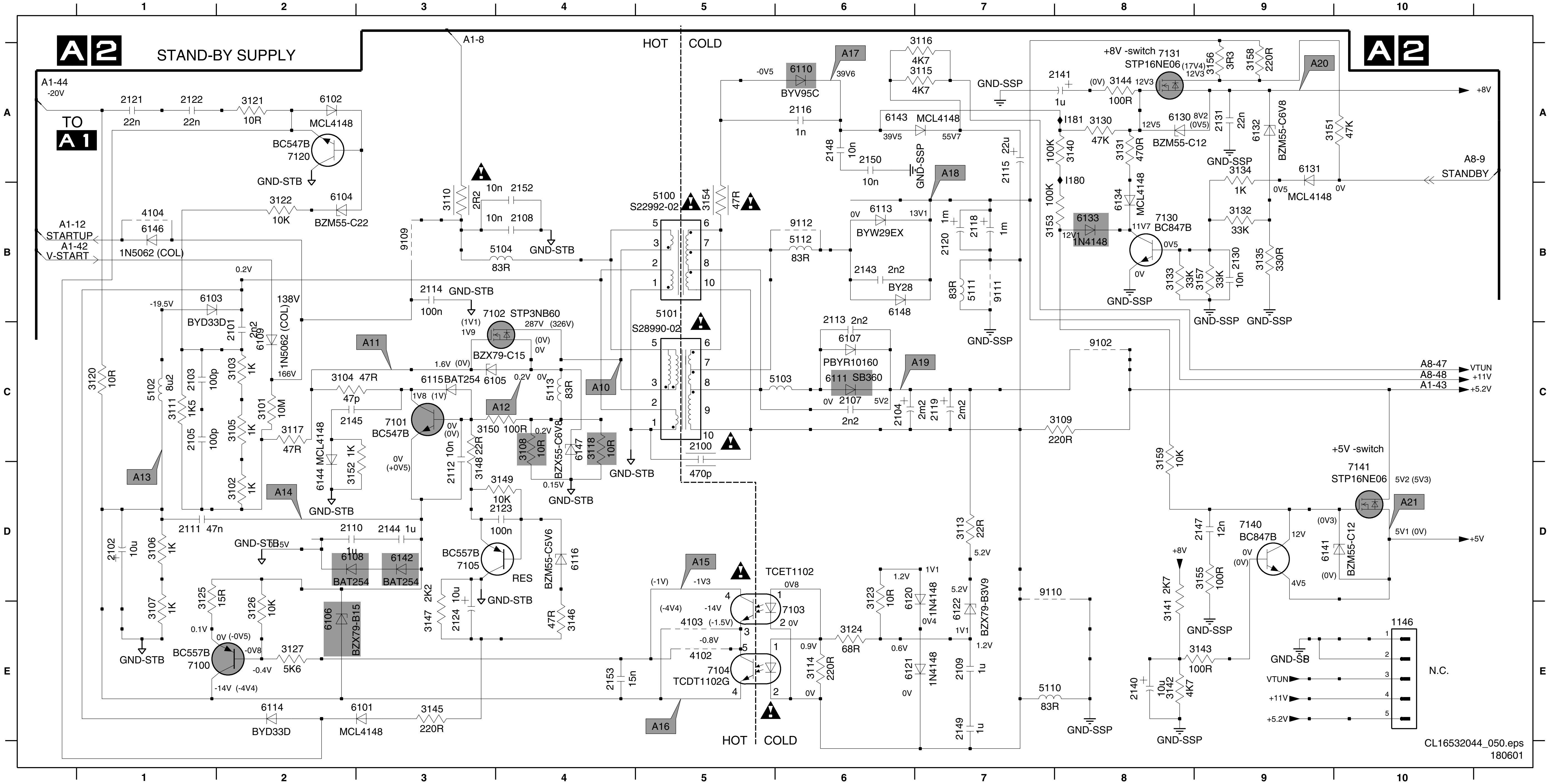
## Large Signal Panel: Main Supply




| Ref | Loc | Ref | Loc | Ref | Loc |
|---|---|---|---|---|---|
| 0043 | D1 | 3519 | F5 | 7529 | F4 |
| 1500 | B1 | 3520 | D6 | 7530 | C4 |
| 1501 | A1 | 3521 | B1 | 9501 | B1 |
| 1502 | C1 | 3522 | E5 | 9502 | C1 |
| 1503 | A4 | 3523 | D6 | 9503 | B3 |
| 1505 | C1 | 3524 | E9 | 9504 | B3 |
| 1510 | F2 | 3525 | D6 | 9510 | D5 |
| 1550 | D8 | 3526 | E6 | 9511 | C5 |
| 1590 | C2 | 3527 | E7 | 9512 | A2 |
| 2501 | C5 | 3528 | E8 | 9513 | A3 |
| 2502 | B5 | 3529 | E8 | 9516 | C2 |
| 2503 | A6 | 3530 | E7 | 9517 | B4 |
| 2504 | B5 | 3531 | E4 | 9518 | E4 |
| 2505 | F2 | 3532 | E9 | 9519 | E3 |
| 2506 | A3 | 3533 | F6 | | |
| 2507 | B1 | 3534 | F9 | | |
| 2508 | B3 | 3540 | D7 | | |
| 2509 | A3 | 3542 | E6 | | |
| 2510 | C6 | 3543 | A6 | | |
| 2511 | B8 | 3549 | E7 | | |
| 2512 | B8 | 3550 | D3 | | |
| 2513 | D6 | 3551 | C2 | | |
| 2514 | D6 | 3552 | B4 | | |
| 2515 | C6 | 3553 | C4 | | |
| 2516 | C3 | 4505 | F5 | | |
| 2517 | C4 | 5502 | B3 | | |
| 2518 | A6 | 5503 | B2 | | |
| 2519 | B8 | 5504 | B2 | | |
| 2520 | D2 | 5505 | C5 | | |
| 2522 | C8 | 5506 | C6 | | |
| 2523 | C6 | 5507 | B7 | | |
| 2524 | E7 | 5509 | C8 | | |
| 2525 | B6 | 5511 | A3 | | |
| 2528 | E9 | 5512 | B7 | | |
| 2530 | F5 | 5513 | C9 | | |
| 2531 | D7 | 5514 | B8 | | |
| 2537 | B3 | 5515 | D2 | | |
| 2538 | E5 | 5516 | A2 | | |
| 2540 | F6 | 6505 | B4 | | |
| 2541 | A5 | 6506 | B5 | | |
| 2542 | B9 | 6508 | C5 | | |
| 2543 | B9 | 6509 | D6 | | |
| 2544 | C4 | 6510 | A5 | | |
| 3500 | A2 | 6511 | D8 | | |
| 3501 | C2 | 6512 | E8 | | |
| 3502 | F2 | 6514 | C6 | | |
| 3503 | F1 | 6515 | C5 | | |
| 3504 | B5 | 6516 | F6 | | |
| 3505 | B6 | 6517 | E5 | | |
| 3506 | E6 | 6523 | F5 | | |
| 3507 | D7 | 6525 | A3 | | |
| 3508 | A6 | 6530 | A4 | | |
| 3509 | B1 | 6533 | F6 | | |
| 3510 | E7 | 6534 | C5 | | |
| 3511 | A6 | 6535 | A8 | | |
| 3512 | B6 | 6536 | C8 | | |
| 3513 | A6 | 7501 | E8 | | |
| 3514 | B5 | 7502 | B6 | | |
| 3515 | B5 | 7504 | A4 | | |
| 3516 | E4 | 7506 | E6 | | |
| 3517 | E5 | 7507 | C4 | | |
| 3518 | A4 | 7528 | E8 | | |

## Large Signal Panel: Standby Supply

| 1146 E10 | 2110 D2 | 2121 A1 | 2145 C2 | 3104 C2 | 3115 A7 | 3126 E2 | 3142 E8 | 3152 D2 | 4104 B1 | 6101 E3 | 6111 C6 | 6132 A9 | 7100 E1 | 7141 D10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2100 C5 | 2111 D1 | 2122 A1 | 2147 D9 | 3105 C2 | 3116 A7 | 3127 E2 | 3143 E9 | 3153 B7 | 5100 B5 | 6102 A2 | 6113 B6 | 6133 B8 | 7101 C3 | 9102 C8 |
| 2101 C2 | 2112 D3 | 2123 D4 | 2148 A6 | 3106 D1 | 3117 C2 | 3130 A8 | 3144 A8 | 3154 B5 | 5101 B5 | 6103 B1 | 6114 E2 | 6134 B8 | 7102 B3 | 9109 B3 |
| 2102 D1 | 2113 C6 | 2124 E3 | 2149 E7 | 3107 E1 | 3118 C4 | 3131 A8 | 3145 E3 | 3155 D9 | 5102 C1 | 6104 B2 | 6115 C3 | 6141 D9 | 7103 E6 | 9110 D7 |
| 2103 C1 | 2114 B3 | 2130 B9 | 2150 A6 | 3108 C4 | 3120 C1 | 3132 B9 | 3146 E4 | 3156 A9 | 5103 C6 | 6105 C3 | 6116 D4 | 6142 D3 | 7104 E5 | 9111 B7 |
| 2104 C6 | 2115 A7 | 2131 A9 | 2152 B4 | 3109 C8 | 3121 A2 | 3133 B8 | 3147 E3 | 3157 B9 | 5104 B4 | 6106 E2 | 6120 D6 | 6143 A6 | 7105 D3 | 9112 B6 |
| 2105 C1 | 2116 A6 | 2140 E8 | 2153 E4 | 3110 B3 | 3122 B2 | 3134 A9 | 3148 D3 | 3158 A9 | 5110 E7 | 6107 C6 | 6121 E6 | 6144 D2 | 7120 A2 | |
| 2107 C6 | 2118 B7 | 2141 A8 | 3101 C2 | 3111 C1 | 3123 D6 | 3135 B9 | 3149 D4 | 3159 C8 | 5111 B7 | 6108 D2 | 6122 E7 | 6146 B1 | 7130 B8 | |
| 2108 B4 | 2119 C7 | 2143 B6 | 3102 D2 | 3113 D7 | 3124 E6 | 3140 A8 | 3150 C3 | 4102 E5 | 5112 B6 | 6109 C2 | 6130 A8 | 6147 C4 | 7131 A8 | |
| 2109 E7 | 2120 B7 | 2144 D3 | 3103 C2 | 3114 E6 | 3125 D1 | 3141 E8 | 3151 A9 | 4103 E5 | 5113 C4 | 6110 A6 | 6131 A9 | 6148 B6 | 7140 D9 | |

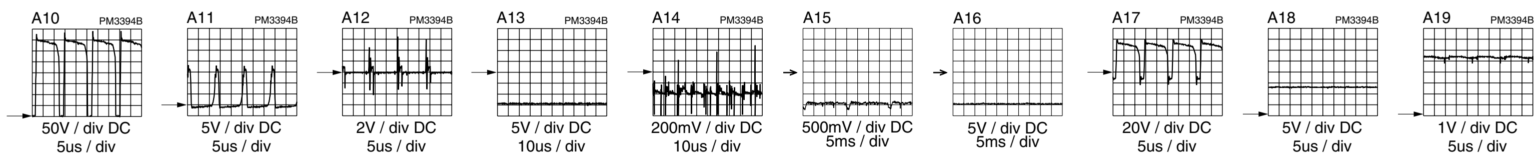



About DC-voltages measured:

NORMAL

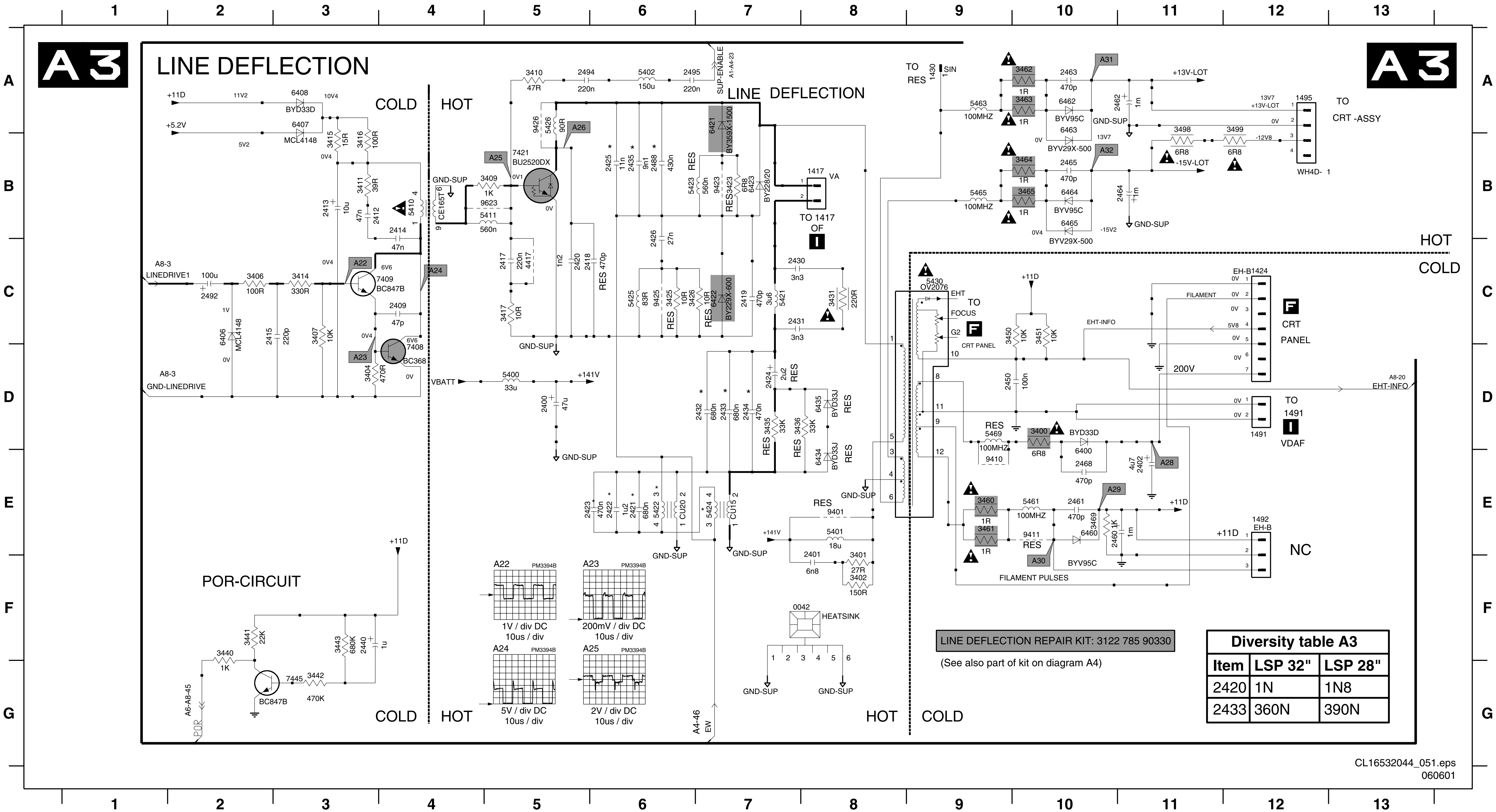
STANDBY ( )

STANDBY SUPPLY REPAIR KIT: 3122 785 90320



## Large Signal Panel: Line Deflection

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0042 F7 | 2400 D5 | 2415 C2 | 2423 E6 | 2433 D7 | 2462 A11 | 2494 A5 | 3407 C3 | 3417 C5 | 3440 F2 | 3461 E9 | 3499 A12 | 5421 C7 | 5461 E10 | 6408 A3 | 6462 A10 | 7445 G3 | 9623 B5 | | |
| 1417 B8 | 2401 F8 | 2417 C5 | 2424 D7 | 2434 D7 | 2463 A10 | 2495 A6 | 3409 B5 | 3423 B7 | 3441 F2 | 3462 A10 | 4417 C5 | 5422 E6 | 5463 A9 | 6421 A7 | 6463 A10 | 9401 E8 | | | |
| 1424 C12 | 2402 E11 | 2418 C6 | 2425 B6 | 2435 B6 | 2464 B10 | 3400 D10 | 3410 A5 | 3425 C6 | 3442 G3 | 3463 A10 | 5400 D5 | 5423 B6 | 5465 B9 | 6422 C7 | 6464 B10 | 9410 E9 | | | |
| 1430 A9 | 2409 C4 | 2419 C7 | 2426 B6 | 2440 F3 | 2465 B10 | 3401 F8 | 3411 B3 | 3426 C6 | 3443 F3 | 3464 B10 | 5401 E8 | 5424 E7 | 5469 D9 | 6423 B7 | 6465 B10 | 9411 E10 | | | |
| 1491 D12 | 2412 B3 | 2420 C5 | 2430 C7 | 2450 D9 | 2468 E10 | 3402 F8 | 3414 C3 | 3431 C8 | 3450 C9 | 3465 B10 | 5402 A6 | 5425 C6 | 6400 D10 | 6434 E8 | 7408 D4 | 9423 B7 | | | |
| 1492 E12 | 2413 B3 | 2421 E6 | 2431 C7 | 2460 E10 | 2488 B6 | 3404 D3 | 3415 A3 | 3435 D7 | 3451 C10 | 3469 E10 | 5410 B4 | 5426 A5 | 6406 C2 | 6435 D8 | 7409 C3 | 9425 C6 | | | |
| 1495 A12 | 2414 B4 | 2422 E6 | 2432 D7 | 2461 E10 | 2492 C2 | 3406 C2 | 3416 A3 | 3436 D7 | 3460 E9 | 3498 A11 | 5411 B5 | 5430 C9 | 6407 A3 | 6460 E10 | 7421 B5 | 9426 A5 | | | |

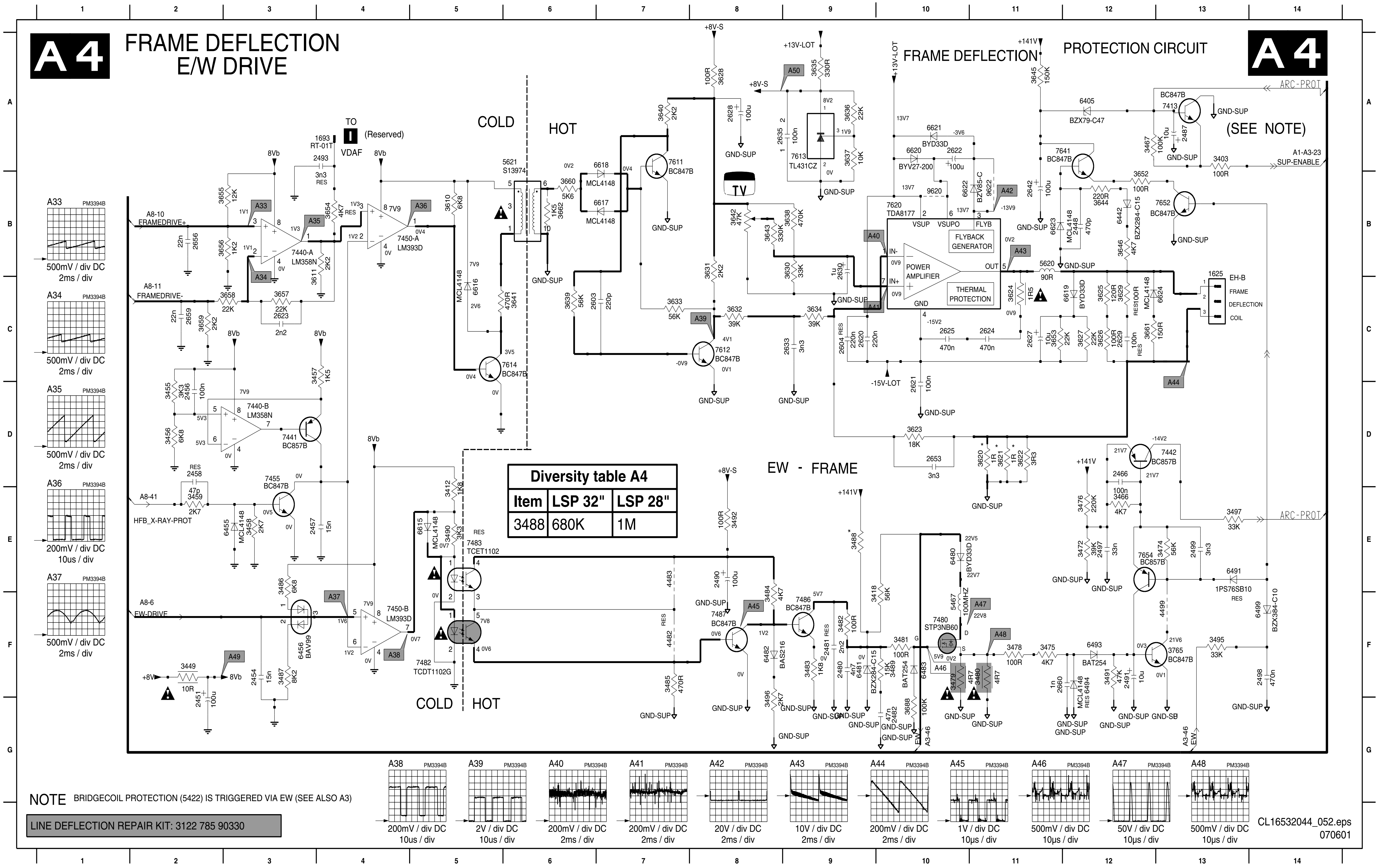



**Diversity table A3**

| Item | LSP 32" | LSP 28" |
|---|---|---|
| 2420 | 1N | 1N8 |
| 2433 | 360N | 390N |

## Large Signal Panel: Frame Deflection

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1625 B13 | 2481 F9 | 2604 C9 | 2630 B9 | 3418 F10 | 3474 E13 | 3485 F7 | 3497 E13 | 3627 C12 | 3637 A9 | 3652 B12 | 3662 B6 | 6455 E3 | 6615 E5 | 7440-A B3 | 7483 E5 | 7653 F13 |
| 1693 A3 | 2482 G10 | 2620 C9 | 2633 C9 | 3449 F2 | 3475 F11 | 3486 E3 | 3610 B5 | 3628 A8 | 3638 B9 | 3653 C11 | 3688 G10 | 6456 F3 | 6616 C5 | 7440-B D3 | 7486 F9 | 7654 E12 |
| 2448 B12 | 2487 A13 | 2621 D10 | 2635 A8 | 3455 D2 | 3476 E12 | 3487 F3 | 3611 C3 | 3629 C12 | 3639 C6 | 3654 B4 | 4482 F7 | 6480 E10 | 6617 B7 | 7441 D3 | 7487 F8 | 9620 B10 |
| 2451 G2 | 2490 E8 | 2622 A10 | 2642 B11 | 3456 D2 | 3478 F11 | 3488 E9 | 3620 D11 | 3630 B9 | 3640 A7 | 3655 B3 | 4483 E7 | 6481 F9 | 6618 A7 | 7442 D13 | 7611 A7 | 9622 B11 |
| 2454 F3 | 2491 F12 | 2623 C3 | 2653 D10 | 3457 C4 | 3479 F10 | 3489 F10 | 3621 D11 | 3631 B8 | 3641 C6 | 3656 B3 | 4499 F13 | 6482 F8 | 6619 C12 | 7443 A13 | 7612 C8 | |
| 2456 D2 | 2493 A4 | 2624 C11 | 2656 B2 | 3458 E3 | 3480 F11 | 3490 E5 | 3622 D11 | 3632 C8 | 3642 B8 | 3657 C3 | 5467 F10 | 6483 F10 | 6620 A10 | 7450-A B4 | 7613 A9 | |
| 2457 E3 | 2497 E12 | 2625 C10 | 2659 C2 | 3459 E2 | 3481 F10 | 3491 F12 | 3623 D10 | 3633 C7 | 3643 B8 | 3658 C3 | 5620 B11 | 6491 E13 | 6621 A10 | 7450-B F4 | 7614 C5 | |
| 2458 D2 | 2498 F14 | 2627 C11 | 2660 F11 | 3466 E12 | 3482 F9 | 3492 E8 | 3624 C11 | 3634 C9 | 3644 B12 | 3659 C2 | 5621 A5 | 6493 F12 | 6622 B10 | 7455 D3 | 7620 B10 | |
| 2466 D12 | 2499 E13 | 2628 A8 | 3403 A13 | 3467 A12 | 3483 F9 | 3495 F13 | 3625 C12 | 3635 A9 | 3645 A11 | 3660 B6 | 6405 A12 | 6494 F12 | 6623 B11 | 7480 F10 | 7641 A11 | |
| 2480 F9 | 2603 C6 | 2629 C12 | 3412 E5 | 3472 E12 | 3484 F8 | 3496 G8 | 3626 C12 | 3636 A9 | 3646 B12 | 3661 C12 | 6442 B12 | 6499 F14 | 6624 C13 | 7482 F5 | 7652 B13 | |




| Diversity table A4 | | |
|---|---|---|
| Item | LSP 32" | LSP 28" |
| 3488 | 680K | 1M |

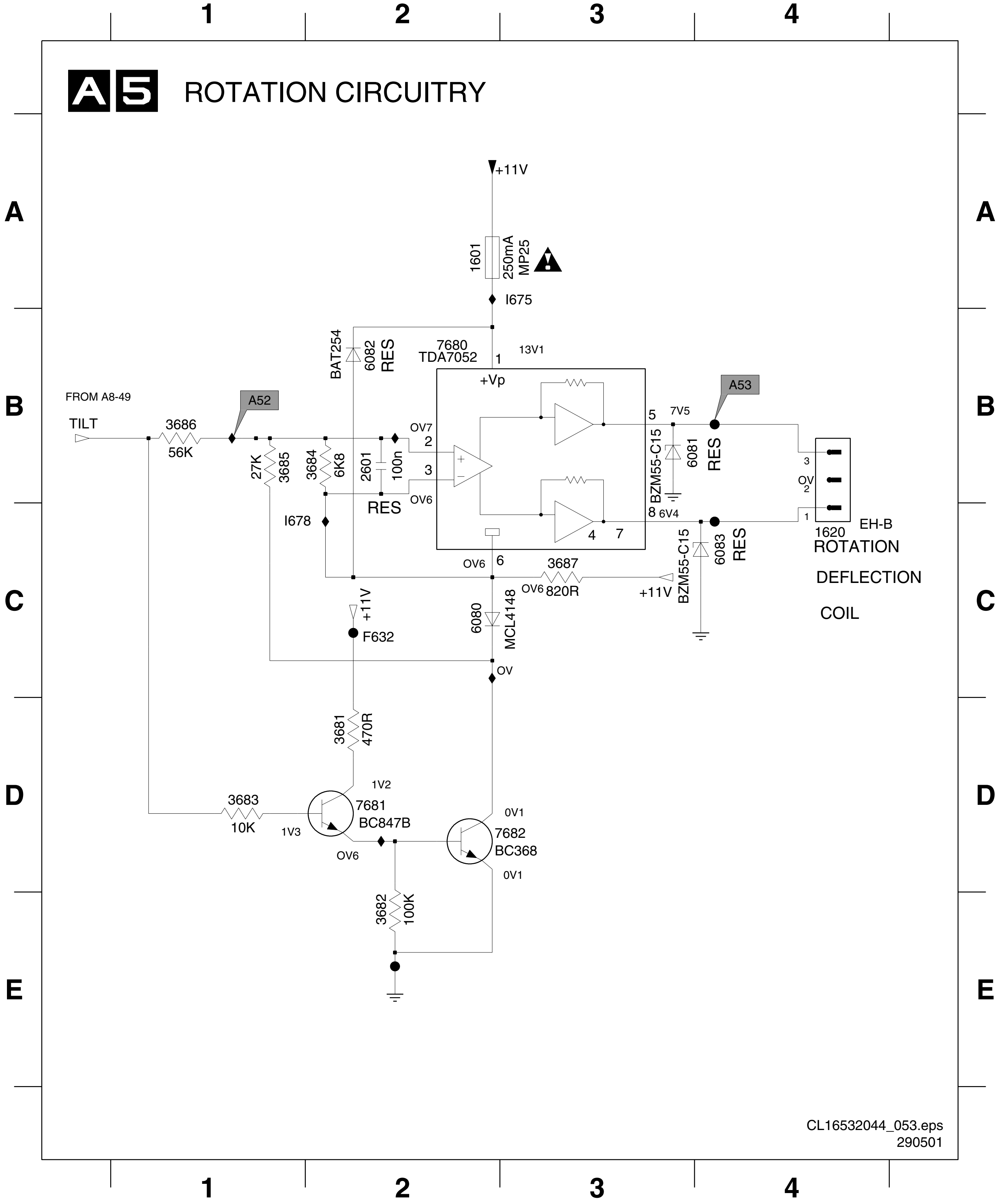
NOTE BRIDGECOIL PROTECTION (5422) IS TRIGGERED VIA EW (SEE ALSO A3)

LINE DEFLECTION REPAIR KIT: 3122 785 90330

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070601

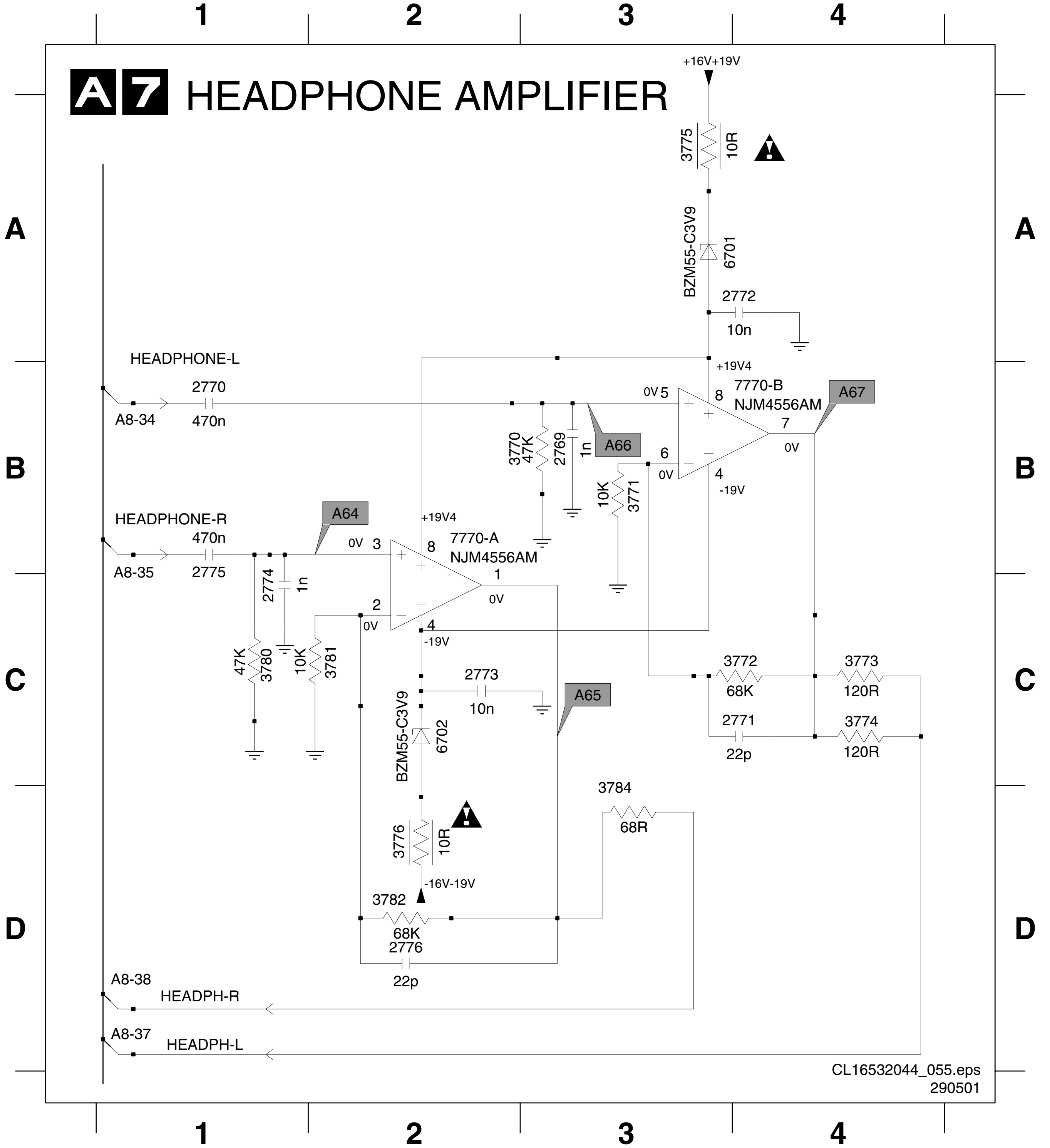
## Large Signal Panel: Rotation Circuitry

| | | | | | |
|---|---|---|---|---|---|
| 1601 A2 | 3681 D2 | 3684 B2 | 3687 C3 | 6082 B2 | 7681 D2 |
| 1620 C4 | 3682 E2 | 3685 B1 | 6080 C2 | 6083 C4 | 7682 D2 |
| 2601 B2 | 3683 D1 | 3686 B1 | 6081 B3 | 7680 B2 | |

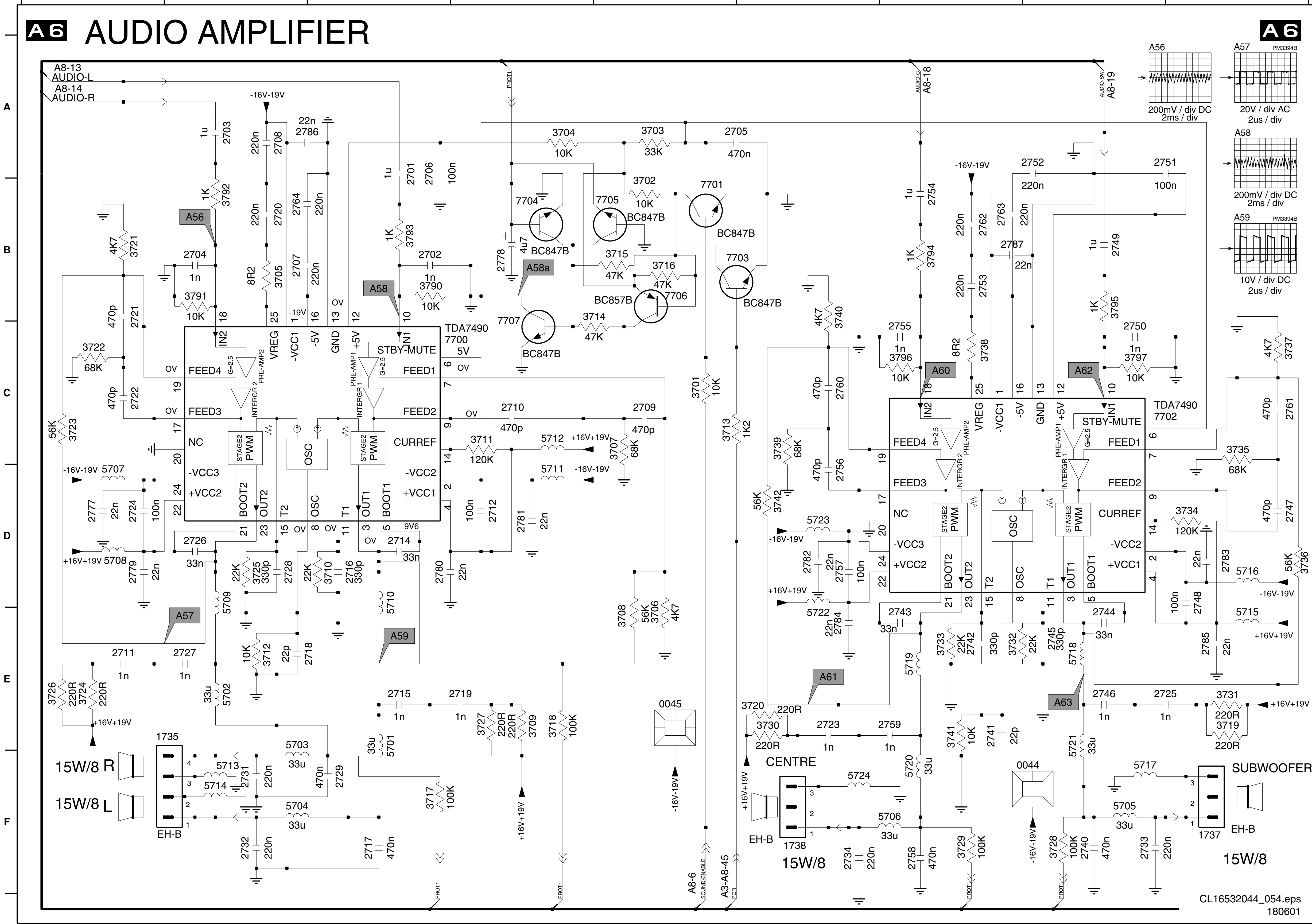



## Large Signal Panel: Headphone Amplifier

| | | | | |
|---|---|---|---|---|
| 2769 B3 | 2774 C1 | 3772 C4 | 3780 C1 | 6702 C2 |
| 2770 B1 | 2775 B1 | 3773 C4 | 3781 C2 | 7770-A B2 |
| 2771 C4 | 2776 D2 | 3774 C4 | 3782 D2 | 7770-B B4 |
| 2772 A4 | 3770 B2 | 3775 A3 | 3784 D3 | |
| 2773 C2 | 3771 B3 | 3776 D2 | 6701 A3 | |

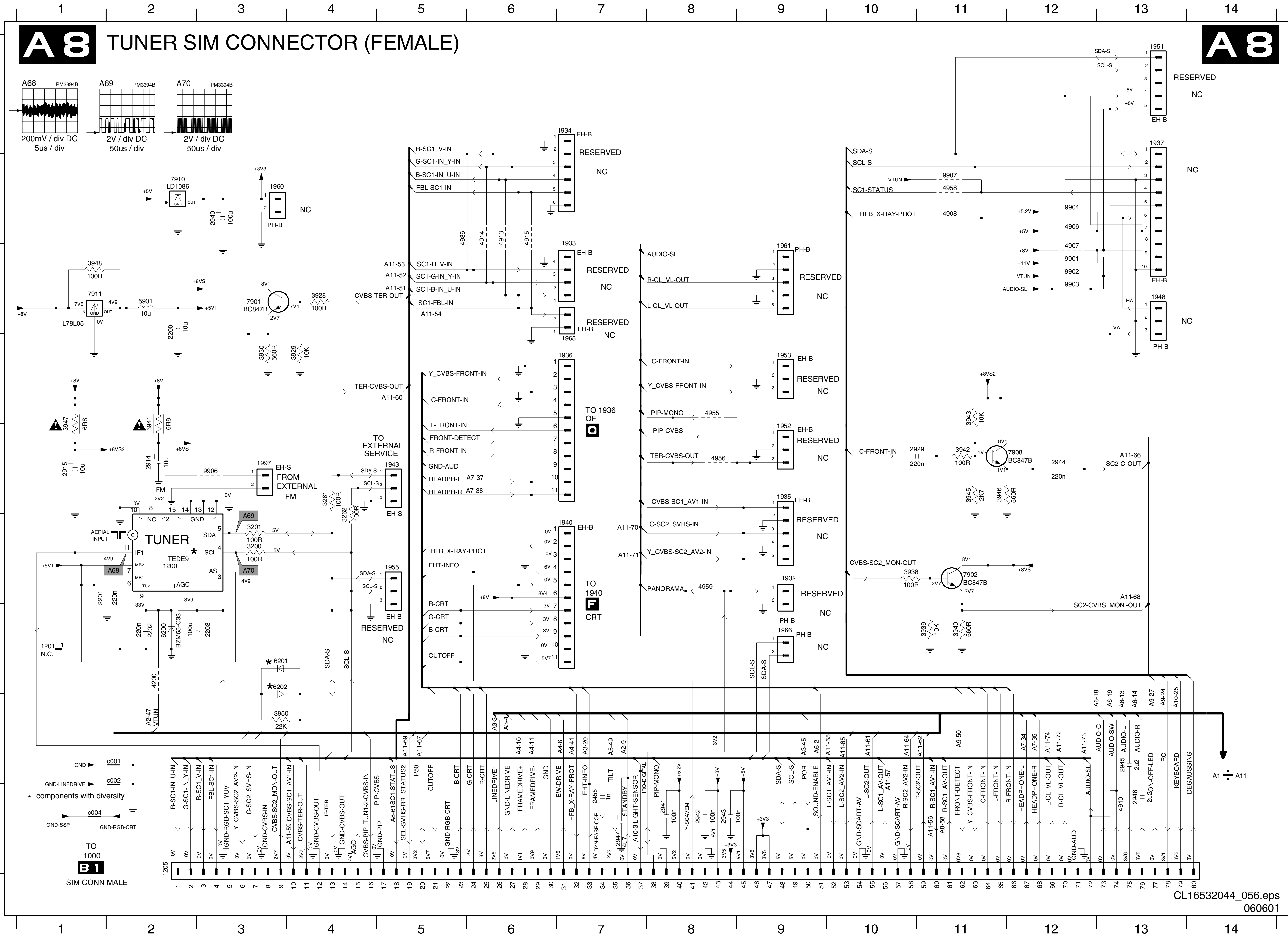


## Large Signal Panel: Audio Amplifier




| Ref | Loc | Ref | Loc | Ref | Loc |
|---|---|---|---|---|---|
| 0044 | F7 | 2764 | B2 | 3797 | C8 |
| 0045 | E5 | 2777 | D1 | 5701 | E3 |
| 1735 | E2 | 2778 | B4 | 5702 | E2 |
| 1737 | F9 | 2779 | D1 | 5703 | E2 |
| 1738 | F6 | 2780 | D3 | 5704 | F2 |
| 2701 | A3 | 2781 | D4 | 5705 | F8 |
| 2702 | B3 | 2782 | D6 | 5706 | F7 |
| 2703 | A2 | 2783 | D9 | 5707 | D1 |
| 2704 | B2 | 2784 | E6 | 5708 | D1 |
| 2705 | A5 | 2785 | E9 | 5709 | D2 |
| 2706 | A3 | 2786 | A2 | 5710 | D3 |
| 2707 | B2 | 2787 | B7 | 5711 | D4 |
| 2708 | A2 | 3701 | C5 | 5712 | C4 |
| 2709 | C5 | 3702 | A5 | 5713 | F2 |
| 2710 | C4 | 3703 | A5 | 5714 | F2 |
| 2711 | E1 | 3704 | A4 | 5715 | E9 |
| 2712 | D4 | 3705 | B2 | 5716 | D9 |
| 2714 | D3 | 3706 | E5 | 5717 | F8 |
| 2715 | E3 | 3707 | C5 | 5718 | E8 |
| 2716 | D3 | 3708 | E5 | 5719 | E7 |
| 2717 | F3 | 3709 | E4 | 5720 | F7 |
| 2718 | E2 | 3710 | D3 | 5721 | E8 |
| 2719 | E4 | 3711 | C4 | 5722 | E6 |
| 2720 | B2 | 3712 | E2 | 5723 | D6 |
| 2721 | B1 | 3713 | C5 | 5724 | F6 |
| 2722 | C1 | 3714 | B5 | 7700 | C3 |
| 2723 | E6 | 3715 | B5 | 7701 | B5 |
| 2724 | D1 | 3716 | B5 | 7702 | C8 |
| 2725 | E8 | 3717 | F3 | 7703 | B5 |
| 2726 | D2 | 3718 | E4 | 7704 | B4 |
| 2727 | E2 | 3719 | E9 | 7705 | B5 |
| 2728 | D2 | 3720 | E6 | 7706 | B5 |
| 2729 | F3 | 3721 | B1 | 7707 | C4 |
| 2731 | F2 | 3722 | C1 | | |
| 2732 | F2 | 3723 | C1 | | |
| 2733 | F8 | 3724 | E1 | | |
| 2734 | F6 | 3725 | D2 | | |
| 2740 | F8 | 3726 | E1 | | |
| 2741 | E7 | 3727 | E4 | | |
| 2742 | E7 | 3728 | F8 | | |
| 2743 | E7 | 3729 | F7 | | |
| 2744 | E8 | 3730 | E6 | | |
| 2745 | E8 | 3731 | E9 | | |
| 2746 | E8 | 3732 | E7 | | |
| 2747 | D9 | 3733 | E7 | | |
| 2748 | D9 | 3734 | D9 | | |
| 2749 | B8 | 3735 | C9 | | |
| 2750 | C8 | 3736 | D9 | | |
| 2751 | A8 | 3737 | C9 | | |
| 2752 | A8 | 3738 | C7 | | |
| 2753 | B7 | 3739 | C6 | | |
| 2754 | B7 | 3740 | B6 | | |
| 2755 | C7 | 3741 | E7 | | |
| 2756 | D6 | 3742 | D6 | | |
| 2757 | D6 | 3790 | B3 | | |
| 2758 | F7 | 3791 | B2 | | |
| 2759 | E7 | 3792 | B2 | | |
| 2760 | C6 | 3793 | B3 | | |
| 2761 | C9 | 3794 | B7 | | |
| 2762 | B7 | 3795 | B8 | | |
| 2763 | B7 | 3796 | C7 | | |

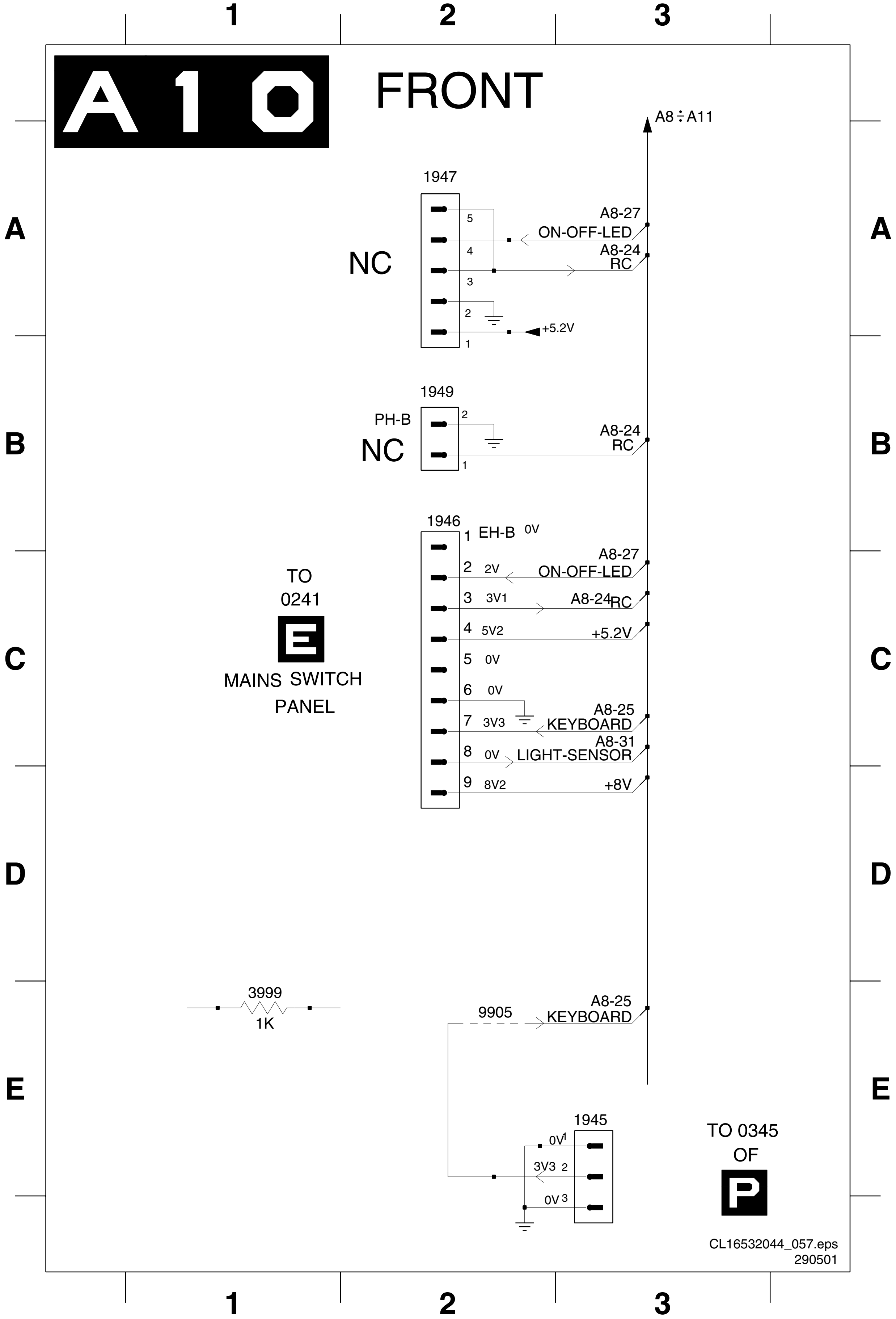
## Large Signal Panel: Tuner SIM Connector (Female)




1200 F2
1201 G1
1205 I2
1932 F9
1933 B7
1934 A7
1935 E9
1936 D7
1937 A13
1940 F7
1943 E5
1948 C13
1951 A13
1952 E9
1953 D9
1955 F5
1960 B3
1961 C9
1965 D7
1966 G9
1997 E3
2200 C2
2201 F1
2202 G2
2203 G3
2455 I7
2914 E2
2915 E1
2929 E11
2940 B3
2941 I8
2942 I8
2943 I8
2944 E12
2945 H13
2946 I13
2947 I7
3200 F3
3201 F3
3261 E4
3262 F4
3928 C4
3929 D4
3930 D3
3938 F10
3939 G11
3940 G11
3941 D2
3942 E11
3943 D11
3945 E11
3946 E11
3947 D1
3948 C1
3950 H3
4200 G2
4906 B12
4907 C12
4908 B11
4910 I13
4913 B6
4914 B6
4915 B6
4936 B5
4955 D8
4956 E8
4958 B11
4959 F8
5901 C2
6200 G2
6201 G3
6202 G3
7901 C3
7902 F11
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7910 B2
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9902 C12
9903 C12
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9906 E3
9907 B11

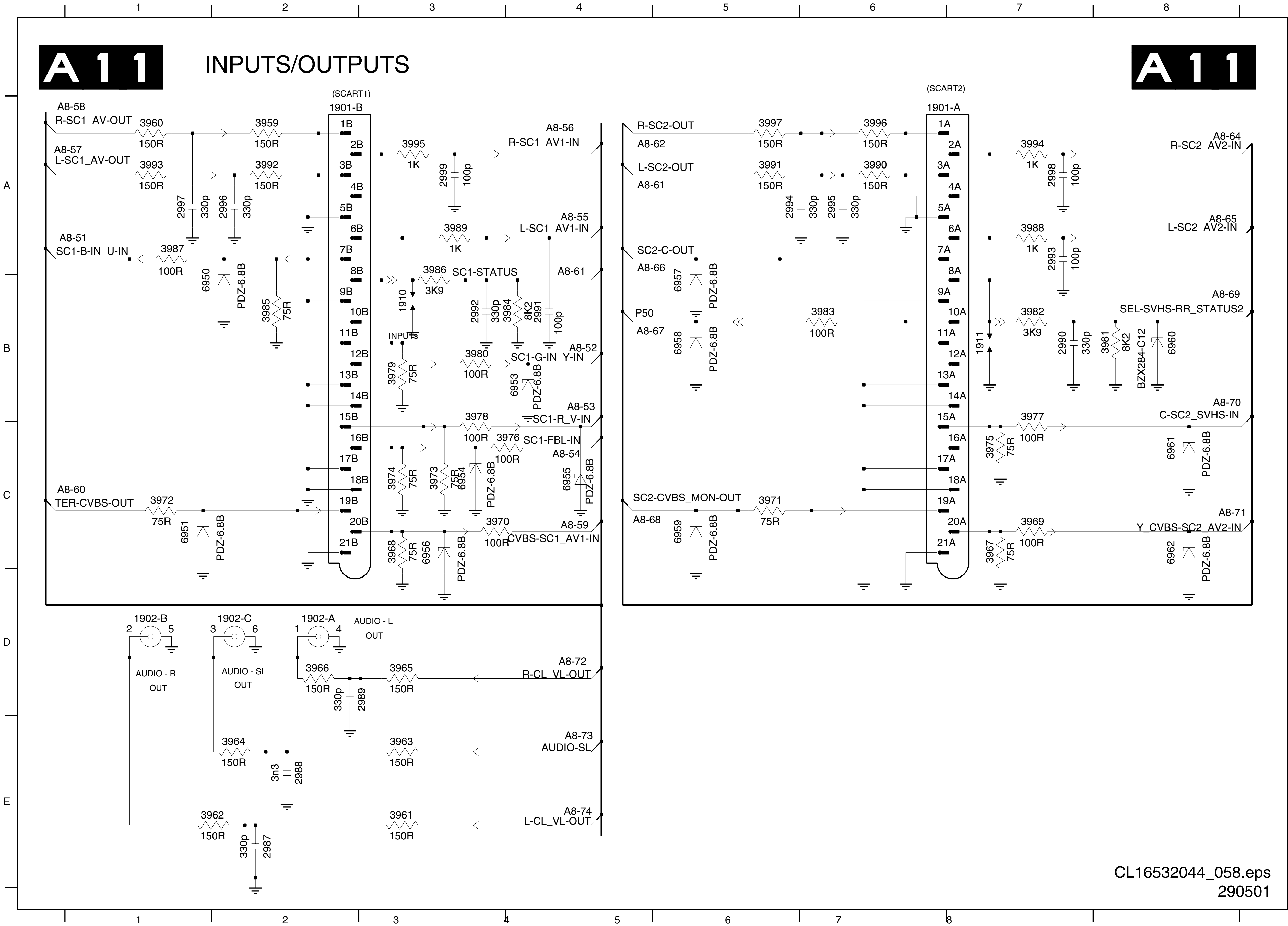
## Large Signal Panel: Front

| | |
|---|---|
| 1945 | E3 |
| 1946 | B2 |
| 1947 | A2 |
| 3999 | E1 |
| 9905 | E2 |




### *Personal Notes:*

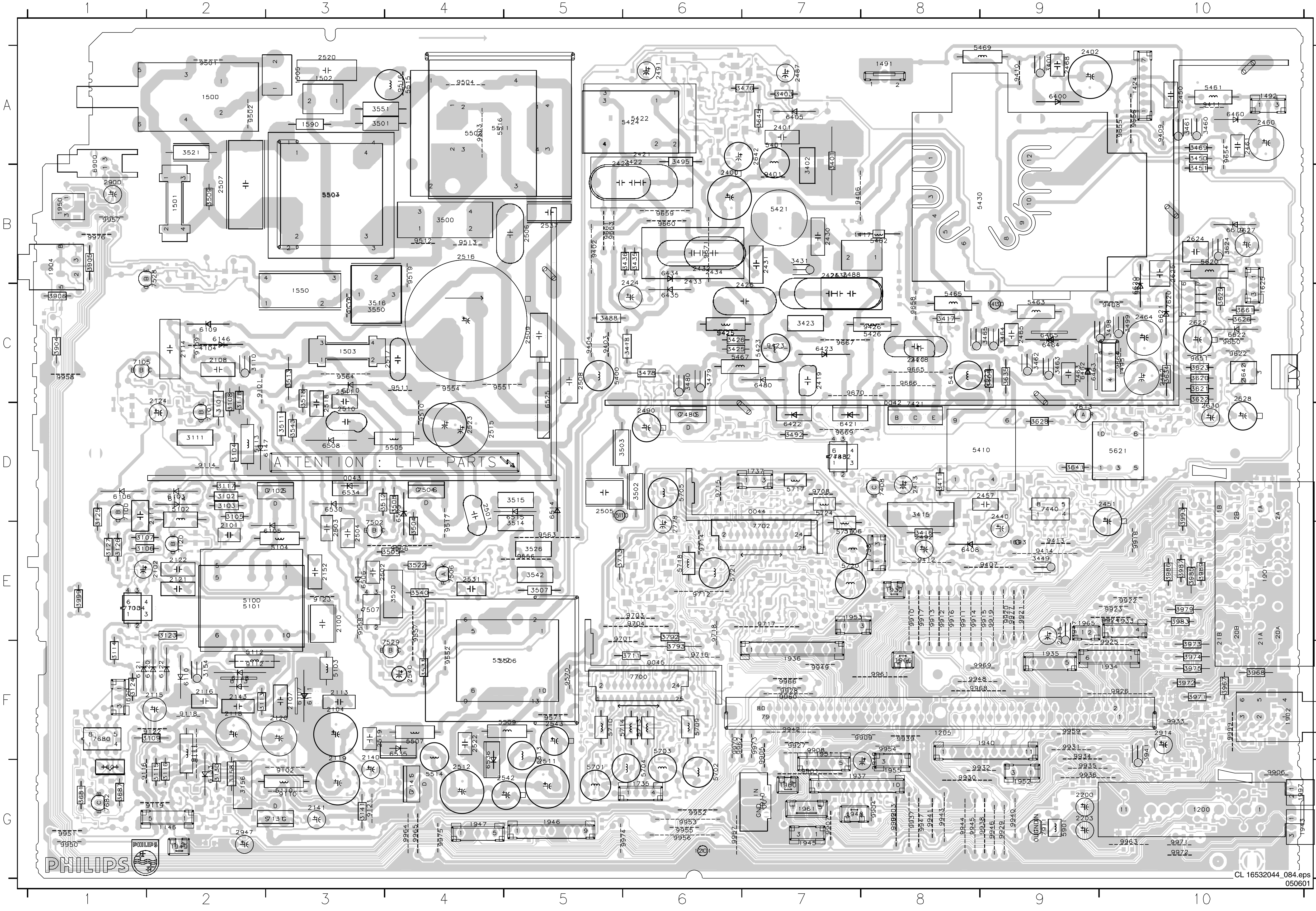
## Large Signal Panel: Inputs / Outputs




| | |
|---|---|
| 1901-A A6 | 3992 A2 |
| 1901-B A2 | 3993 A1 |
| 1902-A D2 | 3994 A7 |
| 1902-B D1 | 3995 A3 |
| 1902-C D2 | 3996 A6 |
| 1910 B3 | 3997 A5 |
| 1911 B7 | 6950 B1 |
| 2987 E2 | 6951 C1 |
| 2988 E2 | 6953 B4 |
| 2989 D2 | 6954 C3 |
| 2990 B7 | 6955 C4 |
| 2991 B4 | 6956 C3 |
| 2992 B3 | 6957 B5 |
| 2993 A7 | 6958 B5 |
| 2994 A5 | 6959 C5 |
| 2995 A6 | 6960 B8 |
| 2996 A2 | 6961 C8 |
| 2997 A1 | 6962 C8 |
| 2998 A7 | |
| 2999 A3 | |
| 3959 A2 | |
| 3960 A1 | |
| 3961 E3 | |
| 3962 E2 | |
| 3963 E3 | |
| 3964 E2 | |
| 3965 D3 | |
| 3966 D2 | |
| 3967 C7 | |
| 3968 C3 | |
| 3969 C7 | |
| 3970 C3 | |
| 3971 C5 | |
| 3972 C1 | |
| 3973 C3 | |
| 3974 C3 | |
| 3975 C7 | |
| 3976 C4 | |
| 3977 B7 | |
| 3978 B3 | |
| 3979 B3 | |
| 3980 B3 | |
| 3981 B8 | |
| 3982 B7 | |
| 3983 B6 | |
| 3984 B4 | |
| 3985 B2 | |
| 3986 A3 | |
| 3987 A1 | |
| 3988 A7 | |
| 3989 A3 | |
| 3990 A6 | |
| 3991 A5 | |

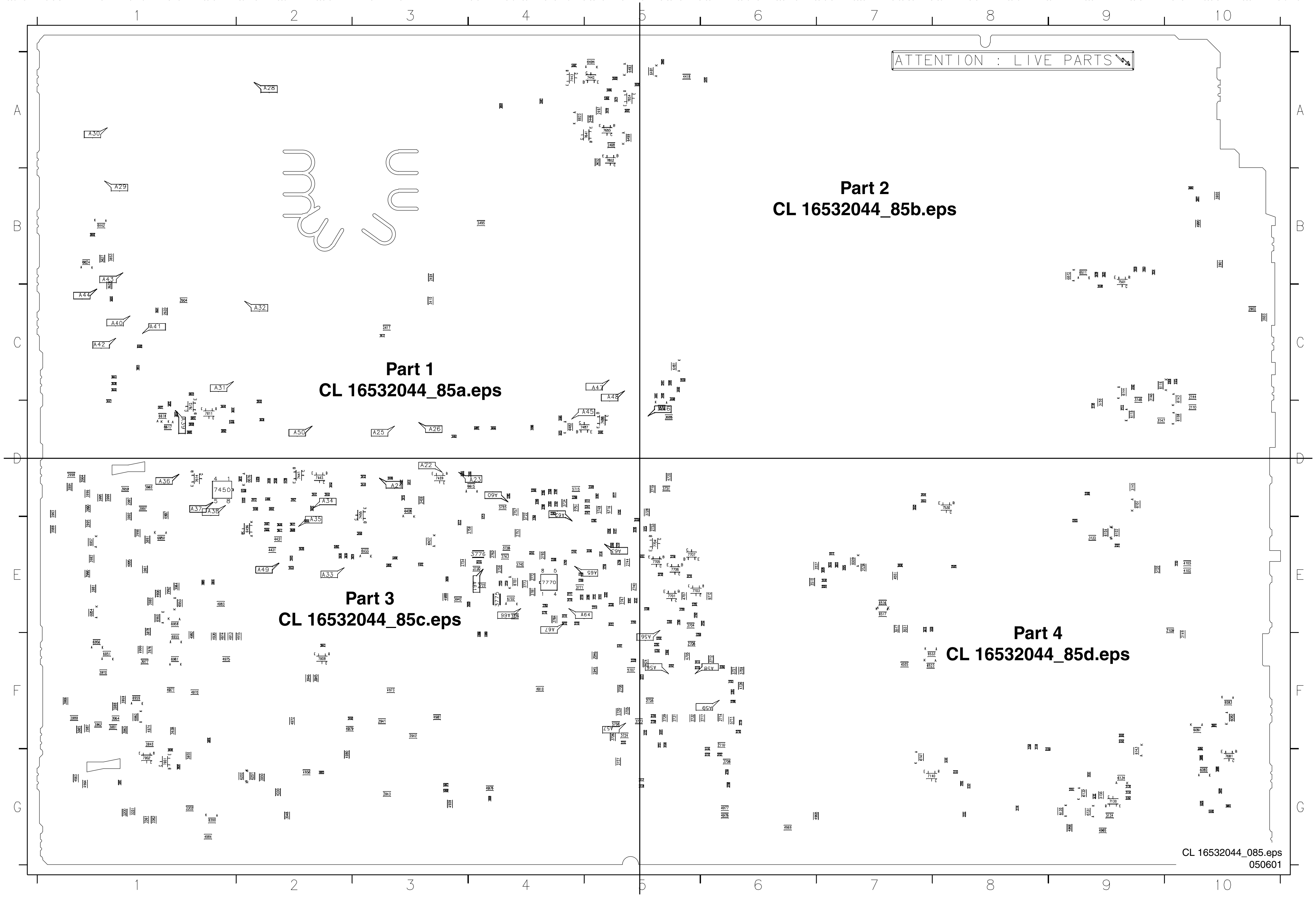
## Layout LSP (Component Side)

0042 C8
0043 D5
0044 D7
0045 F5
1146 G2
1200 G10
1201 G6
1205 F8
1417 B7
1424 A10
1430 C9
1491 A8
1492 A10
1495 C10
1500 A2
1501 B2
1502 A3
1503 C3
1505 A2
1510 E5
1550 B3
1590 A3
1601 G1
1620 F1
1625 C10
1693 E9
1735 G6
1737 D7
1738 E8
1901 E10
1902 F10
1904 B1
1932 E8
1933 E10
1934 F10
1935 F9
1936 F7
1937 G8
1940 F9
1943 G10
1945 G7
1946 G5
1947 G4
1948 G7
1949 G2
1950 B1
1951 G7
1952 G9
1953 E7
1955 G8
1960 G7
1961 G7
1965 E9
1966 F8
1997 G10
2100 E3
2101 E2
2102 E1
2104 F3
2107 F3
2108 C2
2111 D2
2113 F3
2114 C2
2115 F2
2116 F2
2118 F2
2119 F3
2120 F3
2121 E2
2122 E2
2124 C2
2140 G3
2141 G3
2143 F2
2152 E3
2200 G9
2203 G9
2400 B6
2401 A7
2402 A9
2413 D8
2418 C8
2419 C7
2420 C8
2421 B6
2422 A5
2423 A6
2424 B6
2425 C7
2426 C6
2430 B7
2431 B7
2432 B6
2433 C6
2434 B6
2435 C8
2440 E8
2450 A10
2451 D10
2457 D9
2460 A10
2461 A10
2462 C10
2463 C9
2464 C10
2465 C9
2468 A9
2487 A7
2488 C8
2490 D6
2491 A6
2492 E8
2501 D4
2502 E3
2503 E3
2504 E3
2505 D5
2506 B5
2507 A2
2508 C5
2509 C5
2510 D3
2511 G5
2512 G4
2515 D4
2516 B4
2517 C4
2518 D3
2519 F3
2520 A3
2522 F4
2523 D4
2531 E4
2537 B5
2540 F4
2541 C3
2542 G5
2543 F5
2622 C10
2624 B10
2625 B10
2627 B10
2628 C10
2630 D10
2642 A6
2778 E6
2900 B1
2914 F10
2915 E9
2940 F7
2947 G2
3101 D2
3102 D2
3103 D2
3104 D2
3105 D2
3106 E1
3107 E2
3108 D2
3109 F2
3110 C2
3111 D2
3113 F3
3114 F1
3115 G2
3116 G2
3117 D2
3118 C2
3123 E2
3124 F1
3125 D1
3126 E1
3127 E1
3130 G2
3141 G3
3154 F2
3156 G2
3158 G2
3400 A9
3401 A7
3402 B7
3403 A7
3409 C9
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3415 E8
3416 E8
3417 C8
3418 C5
3423 C7
3425 C6
3426 C7
3431 B7
3435 B6
3436 B5
3449 E9
3450 A10
3451 B10
3460 A10
3461 A10
3462 C9
3463 C9
3464 C9
3465 C9
3469 A10
3476 A7
3478 C6
3479 C6
3480 C6
3488 C5
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3498 C10
3499 C10
3500 B4
3501 A3
3502 D6
3503 D6
3504 E4
3505 E4
3507 E5
3508 D4
3509 B2
3511 D3
3512 D3
3513 C3
3514 E4
3515 D5
3516 C3
3518 C3
3520 E4
3521 A2
3522 E4
3526 E5
3533 F4
3540 E4
3542 E5
3543 D3
3550 B4
3551 A3
3620 C10
3621 C10
3622 D10
3623 C10
3624 B10
3625 C10
3626 C10
3628 D9
3634 C10
3635 C9
3641 D9
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3661 C10
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3687 G1
3711 F5
3713 E6
3792 E6
3793 E6
3904 C1
3905 B1
3906 C1
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3974 E10
3975 F10
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3983 E10
3985 E10
3986 E10
3987 E10
3989 E10
3993 D10
3999 E1
4104 C2
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5101 E2
5102 E2
5103 F3
5104 E3
5110 G3
5111 F2
5112 F2
5113 D2
5400 C5
5401 A7
5402 B8
5410 D9
5411 C8
5421 B7
5422 A6
5423 C7
5424 A6
5425 C6
5426 C8
5430 B10
5461 A10
5463 C9
5465 C8
5467 C6
5469 A9
5502 A4
5503 A3
5504 A3
5505 D4
5506 E5
5507 F4
5509 F5
5511 A4
5512 E4
5513 F5
5514 G4
5515 A3
5516 A5
5620 B10
5621 D10
5701 G5
5702 F6
5703 F6
5704 F5
5705 D6
5706 E7
5709 F6
5710 F5
5713 F6
5714 F5
5717 D7
5718 E6
5719 E7
5720 E7
5721 E6
5724 D7
5901 G9
6103 D2
6105 D3
6106 D1
6107 F3
6109 C2
6110 F2
6111 F3
6113 F2
6114 D2
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6121 F1
6122 F2
6133 G2
6146 C2
6147 D3
6148 F2
6400 A9
6405 A7
6408 E8
6421 D8
6422 D7
6423 C7
6434 B6
6435 C6
6460 A10
6462 C9
6463 C9
6464 C9
6465 C9
6480 C7
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6506 E3
6508 D3
6510 C3
6514 D5
6515 D5
6525 D5
6530 D3
6534 D3
6535 G4
6536 G4
6619 B10
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6622 C10
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7102 D3
7103 E1
7104 E2
7105 C1
7120 E2
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7141 G4
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7421 D8
7440 D9
7480 D6
7482 D8
7483 D7
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7504 D4
7506 E4
7507 E4
7528 B2
7529 F4
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7620 C10
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9109 C2
9110 G3
9111 F2
9112 F3
9114 D2
9116 G1
9118 F2
9119 G2
9121 G3
9122 F2
9123 E3
9401 B7
9402 B5
9403 C5
9404 C5
9406 B7
9407 E9
9408 C10
9409 A10
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9411 A10
9412 E8
9413 E9
9414 E9
9423 C7
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9426 C8
9501 A2
9502 A2
9503 A4
9504 A4
9510 D4
9511 C4
9512 B4
9513 B4
9516 A4
9517 E4
9518 C3
9519 B4
9551 C4
9552 F4
9554 C4
9556 E4
9557 E4
9558 E3
9563 E5
9564 C3
9566 E4
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9571 F5
9620 C10
9622 C10
9623 C9
9650 C10
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9666 C8
9667 C7
9669 D8
9670 C7
9671 B6
9701 E5
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9704 E6
9708 D7
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9714 E6
9715 D6
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9718 E6
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9908 F7
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9911 E8
9912 E8
9913 E8
9914 E8
9915 E9
9916 E8
9917 E8
9918 E10
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9921 E9
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9923 E10
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9999 F10

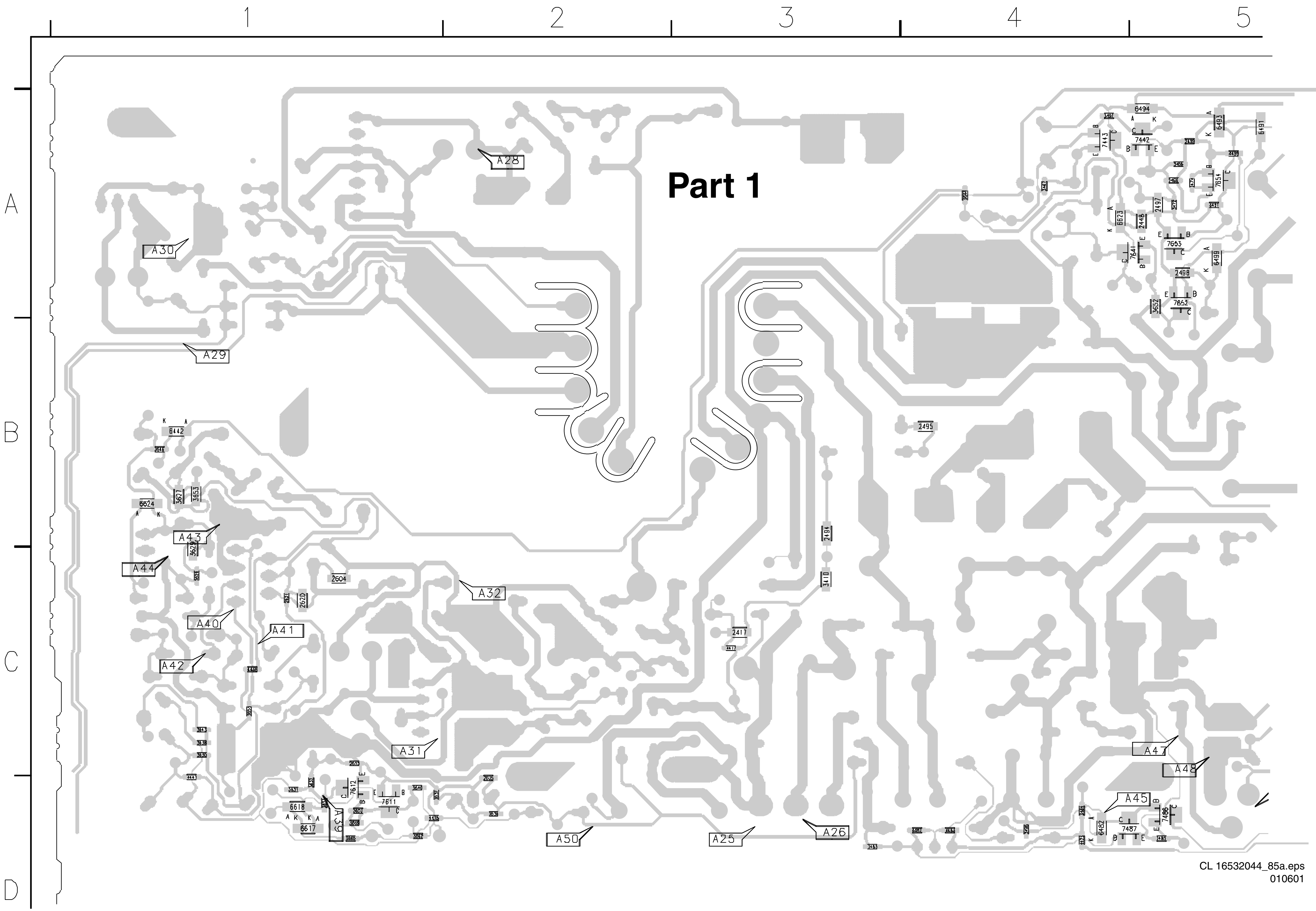


CL 16532044_084.eps
050601

## Layout LSP (Bottom Side Overview)

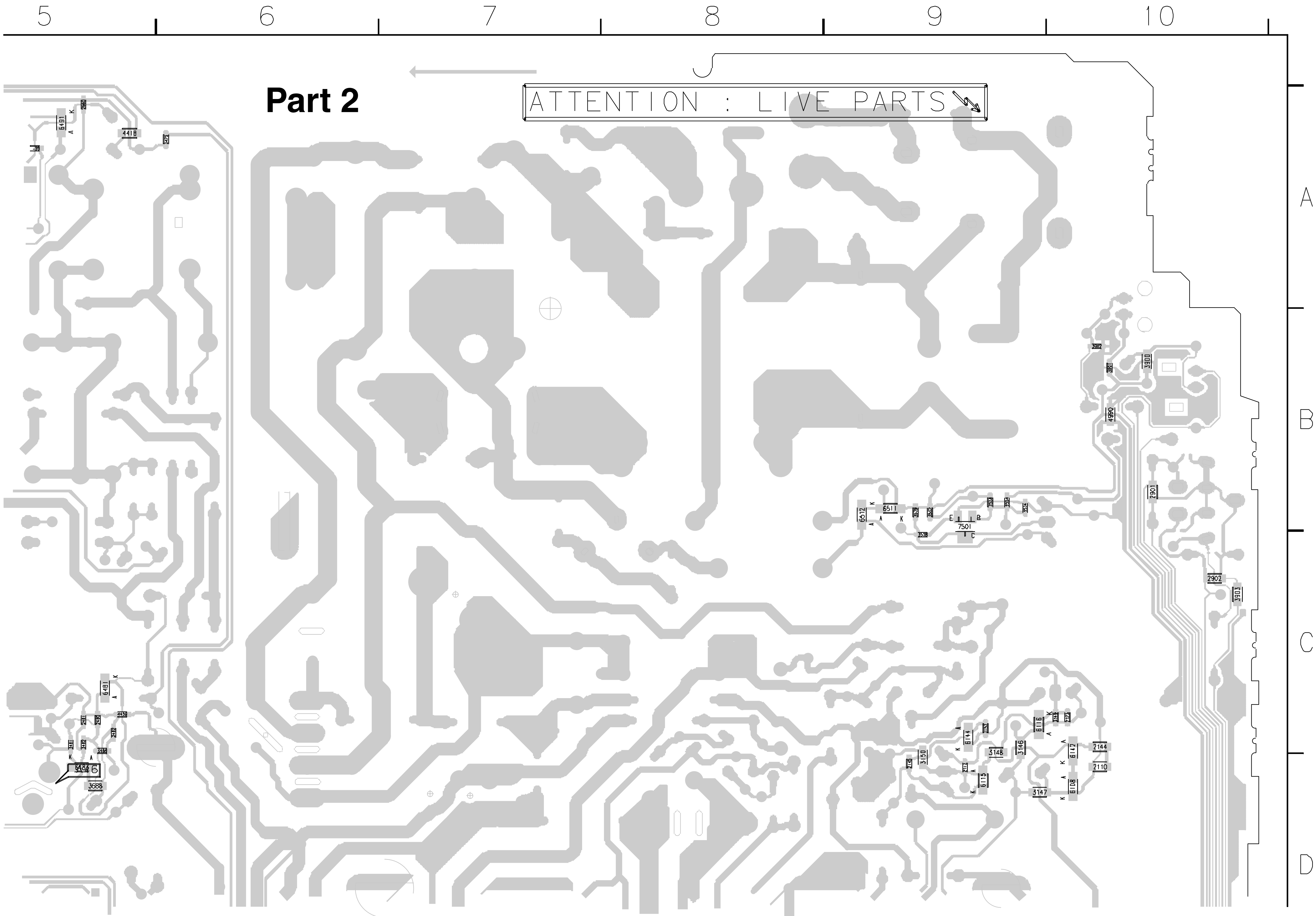


**Layout LSP (Bottom Side Part 1)**



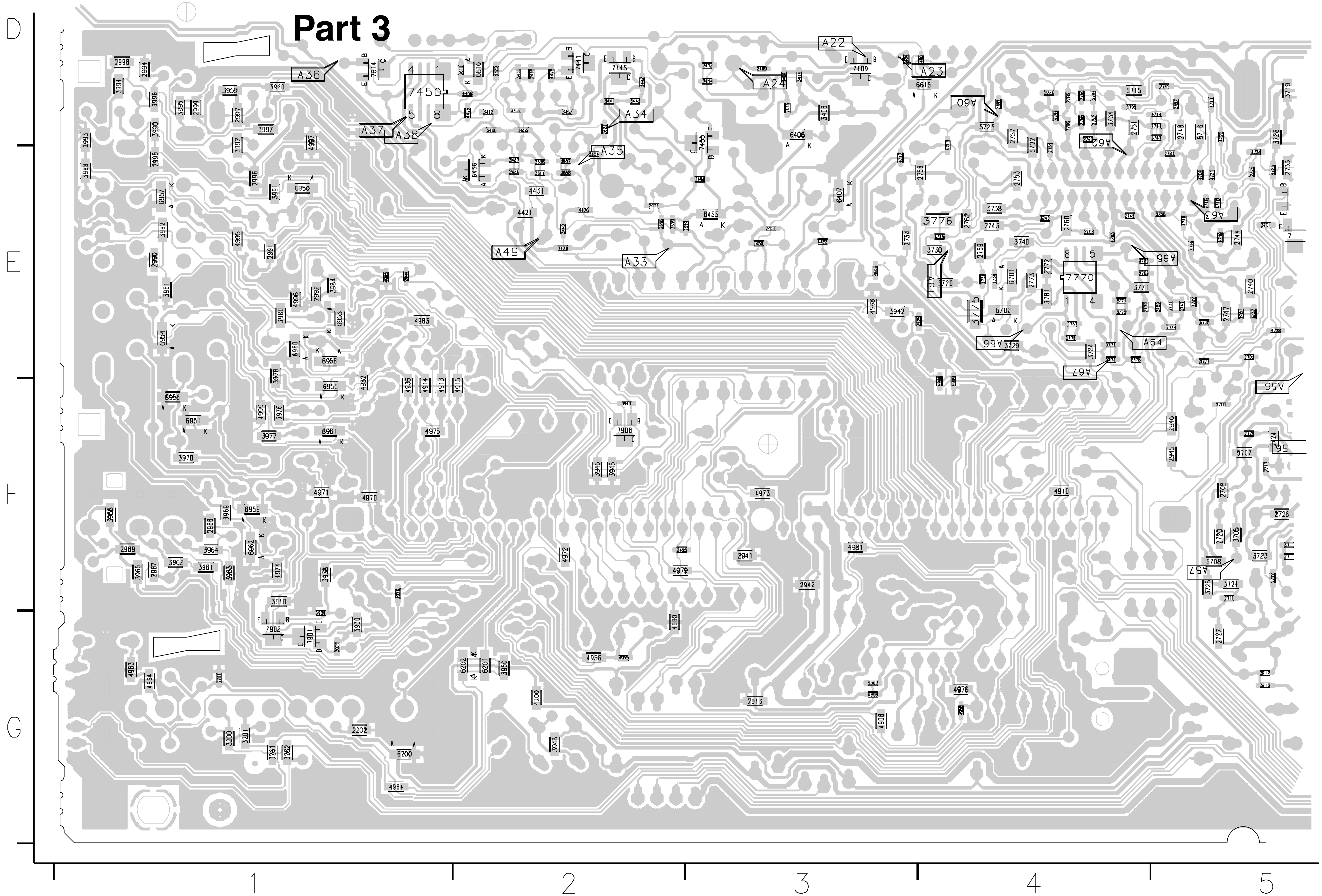

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010601

**Layout LSP (Bottom Side Part 2)**



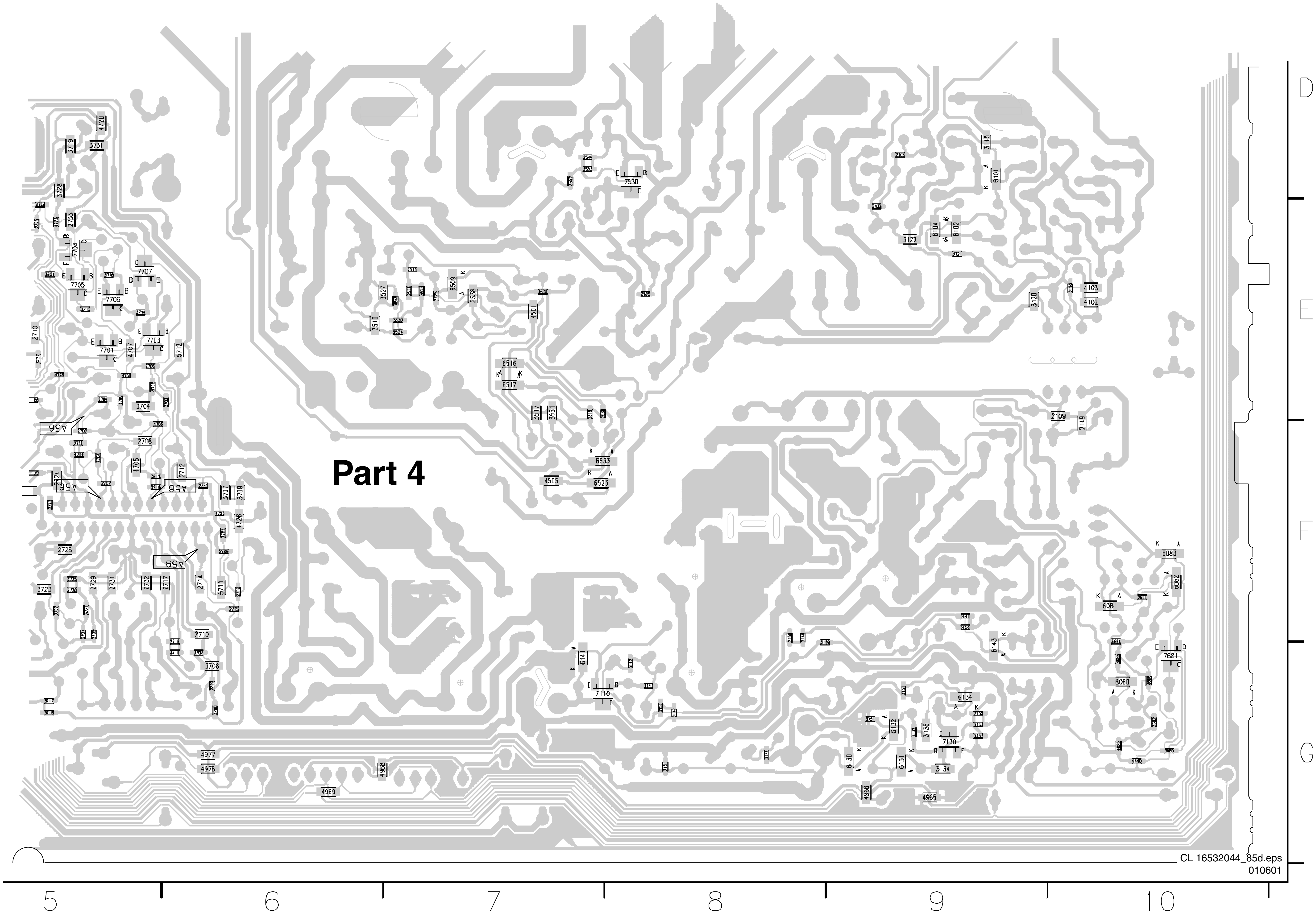

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010601

## Layout LSP (Bottom Side Part 3)




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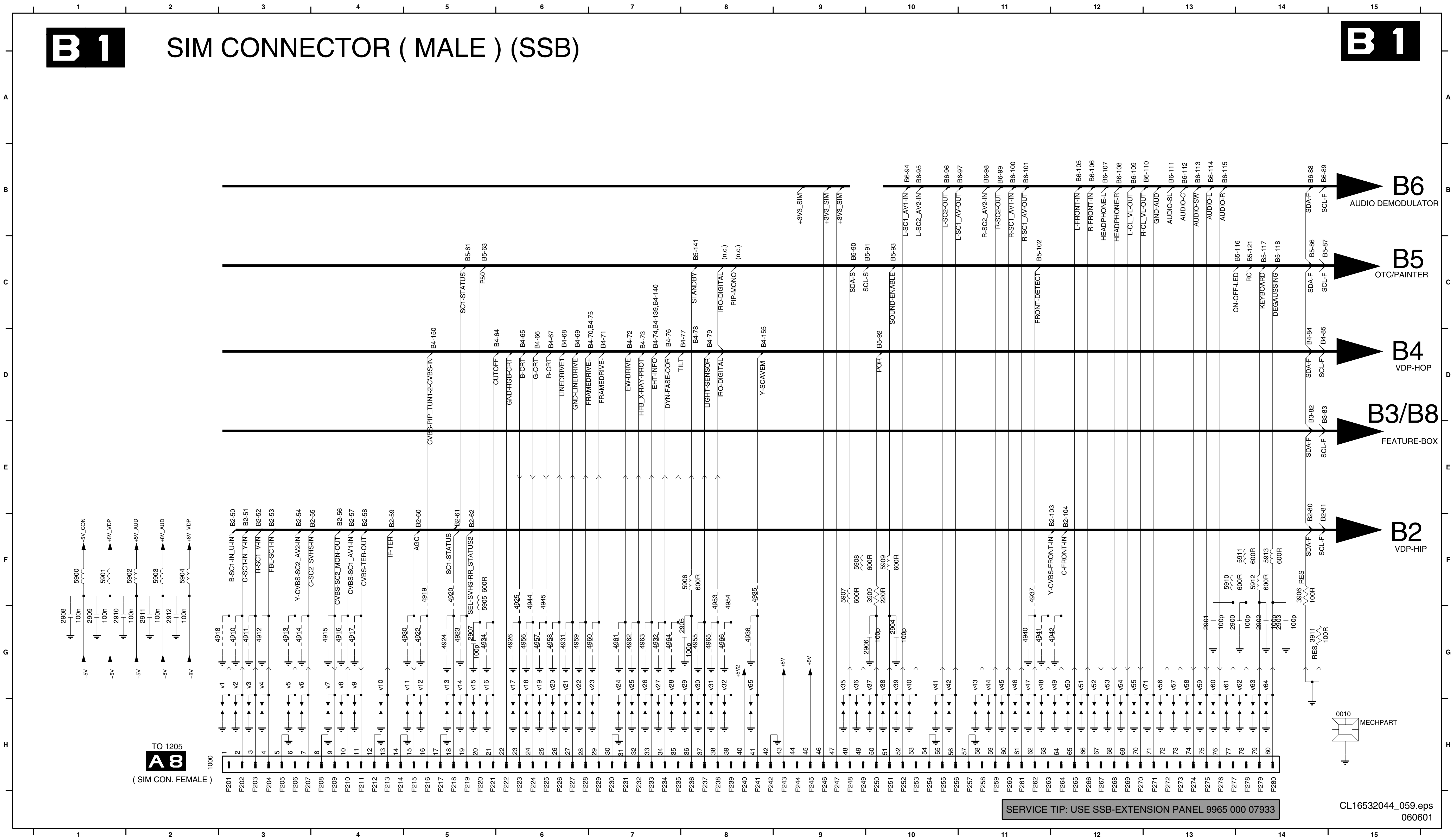
**Layout LSP (Bottom Side Part 4)**



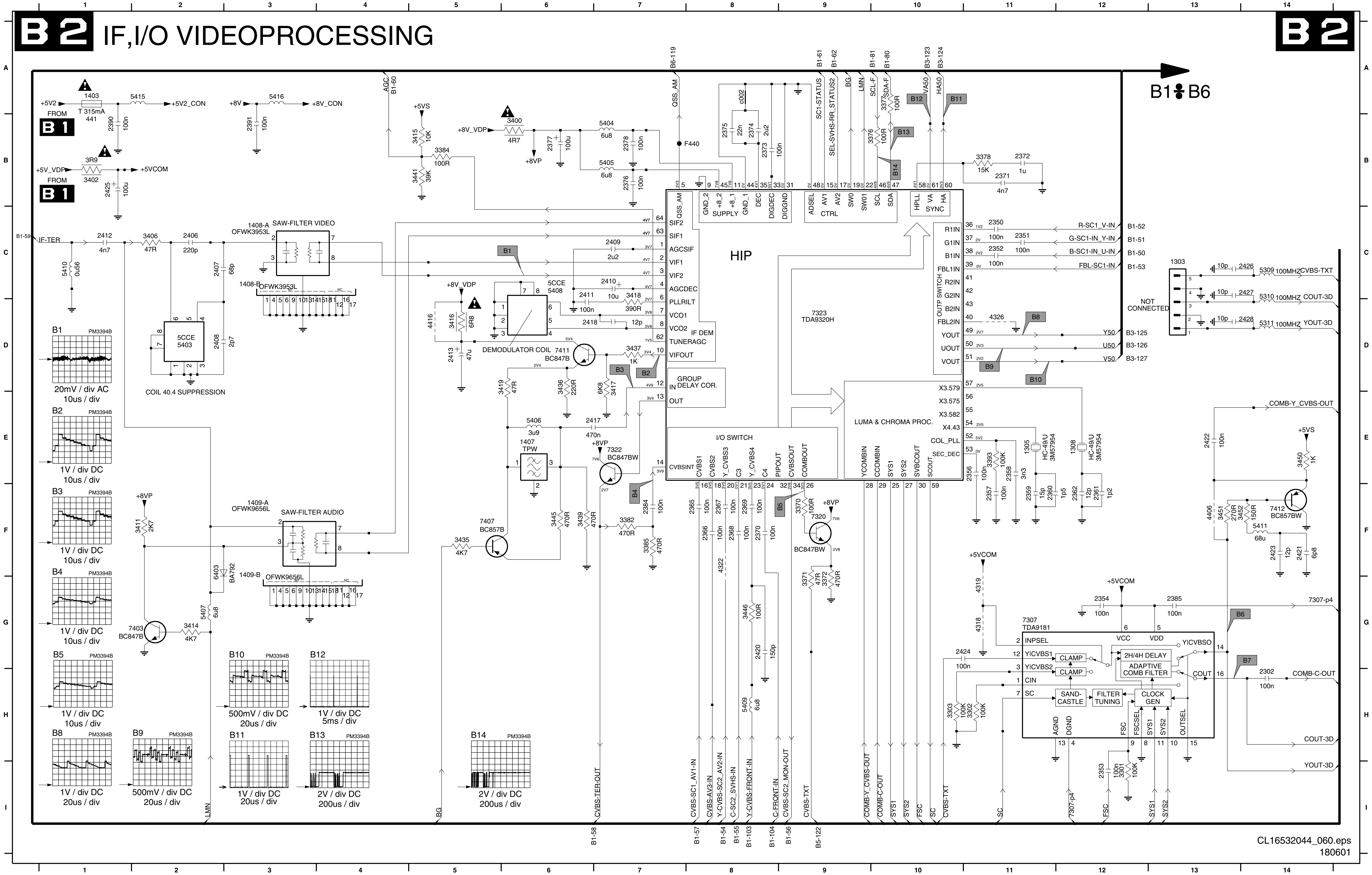

CL 16532044_85d.eps
010601

## Small Signal Board: Sim Connector (Male)

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| v1 G3 | v5 G3 | v9 G4 | v13 G5 | v17 G6 | v21 G6 | v25 G7 | v29 G8 | v35 G9 | v39 G10 | v43 G11 | v47 G11 | v51 G12 | v55 G12 | v59 G13 | v63 G14 | 0010 H15 | 2902 G14 | 2906 G10 | 2910 G1 | 3909 F10 | 4912 G3 | 4916 G4 | 4920 F5 | 4925 F6 | 4932 G7 | 4937 F11 | 4944 F6 | 4955 G8 | 4959 G6 | 4963 G7 | 5900 F1 | 5904 F2 | 5908 F9 | 5912 F14 |
| v2 G3 | v6 G3 | v10 G4 | v14 G5 | v18 G6 | v22 G6 | v26 G7 | v30 G8 | v36 G9 | v40 G10 | v44 G11 | v48 G11 | v52 G12 | v56 G13 | v60 G13 | v64 G14 | 1000 H2 | 2903 G14 | 2907 G5 | 2911 G2 | 3911 G14 | 4913 G3 | 4917 G4 | 4922 G5 | 4926 G6 | 4934 G5 | 4940 G11 | 4945 F6 | 4956 G6 | 4960 G7 | 4964 G7 | 5901 F1 | 5905 F5 | 5909 F10 | 5913 F14 |
| v3 G3 | v7 G4 | v11 G5 | v15 G5 | v19 G6 | v23 G7 | v27 G7 | v31 G8 | v37 G10 | v41 G10 | v45 G11 | v49 G12 | v53 G12 | v57 G13 | v61 G13 | v65 G8 | 2900 G13 | 2904 G10 | 2908 G1 | 2912 G2 | 4910 G3 | 4914 G3 | 4918 G3 | 4923 G5 | 4930 G5 | 4935 F8 | 4941 G11 | 4953 F8 | 4957 G6 | 4961 G7 | 4965 G8 | 5902 F2 | 5906 F8 | 5910 F13 | |
| v4 G3 | v8 G4 | v12 G5 | v16 G5 | v20 G6 | v24 G7 | v28 G7 | v32 G8 | v38 G10 | v42 G10 | v46 G11 | v50 G12 | v54 G12 | v58 G13 | v62 G14 | v71 G12 | 2901 G13 | 2905 G8 | 2909 G1 | 3906 F14 | 4911 G3 | 4915 G4 | 4919 F5 | 4924 G5 | 4931 G6 | 4936 G8 | 4942 G12 | 4954 F8 | 4958 G6 | 4962 G7 | 4966 G8 | 5903 F2 | 5907 F9 | 5911 F14 | |

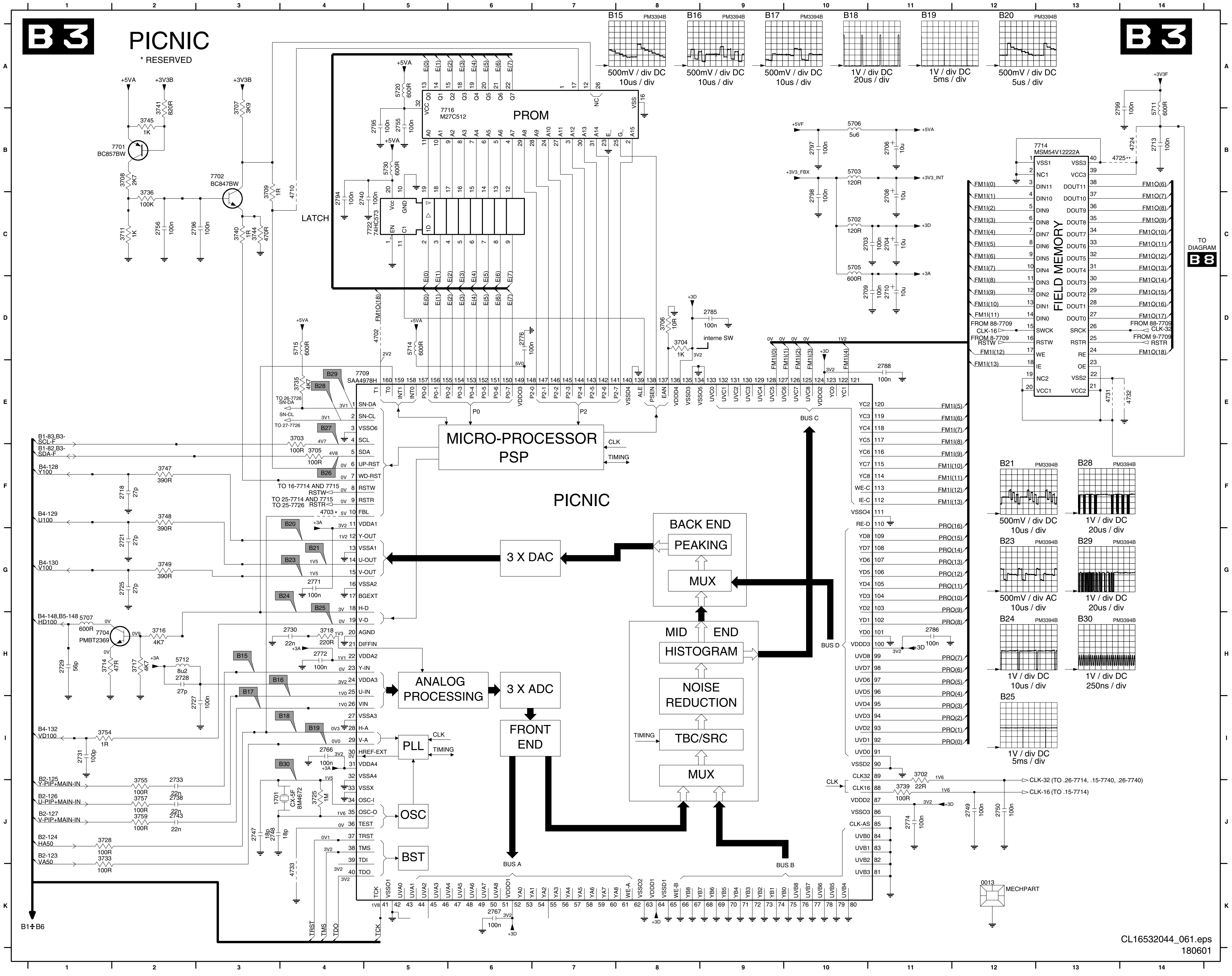


## Small Signal Board: IF, I/O Videoprocessing



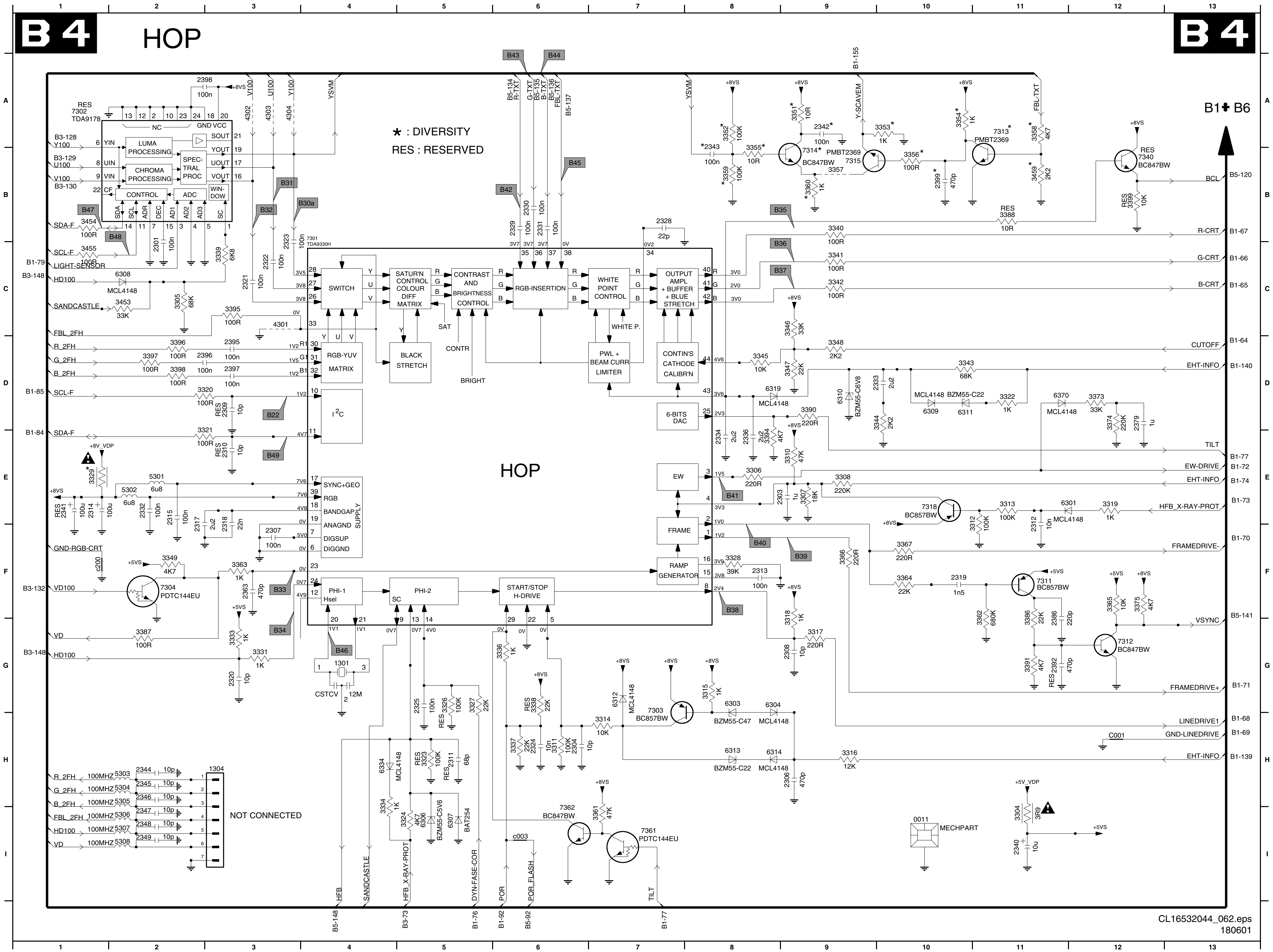

1303 C13
1305 E11
1308 E12
1403 A1
1407 E6
1408-A C3
1408-B C3
1409-A F3
1409-B G3
2302 H14
2350 C11
2351 C11
2352 C11
2353 I12
2354 G12
2356 E11
2357 F11
2358 E11
2359 F11
2360 F11
2361 F12
2362 F12
2365 F8
2366 F8
2367 F8
2368 F8
2369 F8
2370 F8
2371 B11
2372 B11
2373 B8
2374 B8
2375 B8
2376 B7
2377 B6
2378 B7
2384 F7
2385 G13
2390 B1
2391 B3
2406 C2
2407 C2
2408 D2
2409 C7
2410 C7
2411 C6
2412 C1
2413 D5
2417 E6
2418 D6
2420 G8
2421 F14
2422 E13
2423 F14
2424 G10
2425 B1
2426 C14
2427 C14
2428 D14
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3302 H11
3303 H10
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3371 G9
3372 G9
3376 B10
3377 A10
3378 B11
3382 F7
3384 B5
3385 F7
3393 E11
3400 B6
3402 B1
3406 C2
3411 F2
3414 G2
3415 B5
3416 D5
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3418 C7
3419 D6
3435 F5
3436 D6
3437 D7
3439 F6
3441 B5
3445 F6
3446 G8
3450 E14
3451 F13
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4318 G11
4319 G11
4322 F8
4326 D11
4406 F13
4416 D5
5309 C14
5310 C14
5311 D14
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5404 B7
5405 B7
5406 E6
5407 G2
5408 C6
5409 H8
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5415 A2
5416 A3
6403 F2
7307 G11
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7403 G2
7407 F5
7411 D6
7412 F14
c002 A8

## Small Signal Board: PICNIC

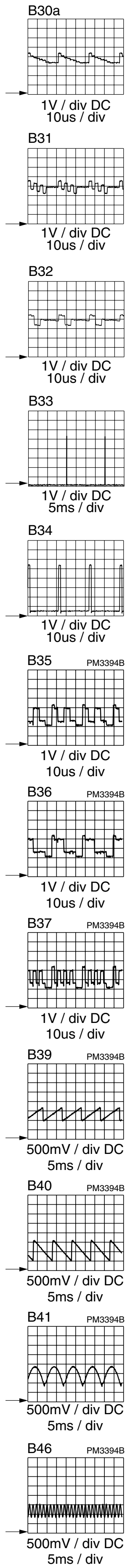



0013 K12
1701 J3
2703 C10
2704 C11
2706 B11
2708 B11
2709 C10
2710 C11
2713 B14
2718 F2
2721 G2
2725 G2
2727 I2
2728 H2
2729 H1
2730 H4
2731 I1
2733 J2
2738 J2
2740 C4
2743 J2
2747 J3
2748 J3
2749 J12
2750 J12
2755 B5
2756 C2
2766 I4
2767 K6
2771 G4
2772 H4
2774 J11
2776 D6
2785 D9
2786 H11
2788 E11
2794 C4
2795 B5
2796 C2
2797 B10
2798 B10
2799 B13
3702 I11
3703 E4
3704 D8
3705 F4
3706 D8
3707 B3
3708 B2
3709 C3
3711 C2
3714 H1
3716 H2
3717 H2
3718 H4
3725 J4
3728 J1
3733 J1
3735 E4
3736 C2
3739 J11
3740 C3
3741 B2
3744 C3
3745 B2
3747 F2
3748 F2
3749 G2
3754 I1
3755 J2
3757 J2
3759 J2
4702 D5
4703 F4
4710 C4
4724 B14
4725 B13
4731 E13
4732 E14
4733 K4
5702 C10
5703 B10
5705 C10
5706 A10
5707 H1
5711 B14
5712 H2
5714 D5
5715 D4
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7709 E4
7714 B12
7716 A6
7722 C5

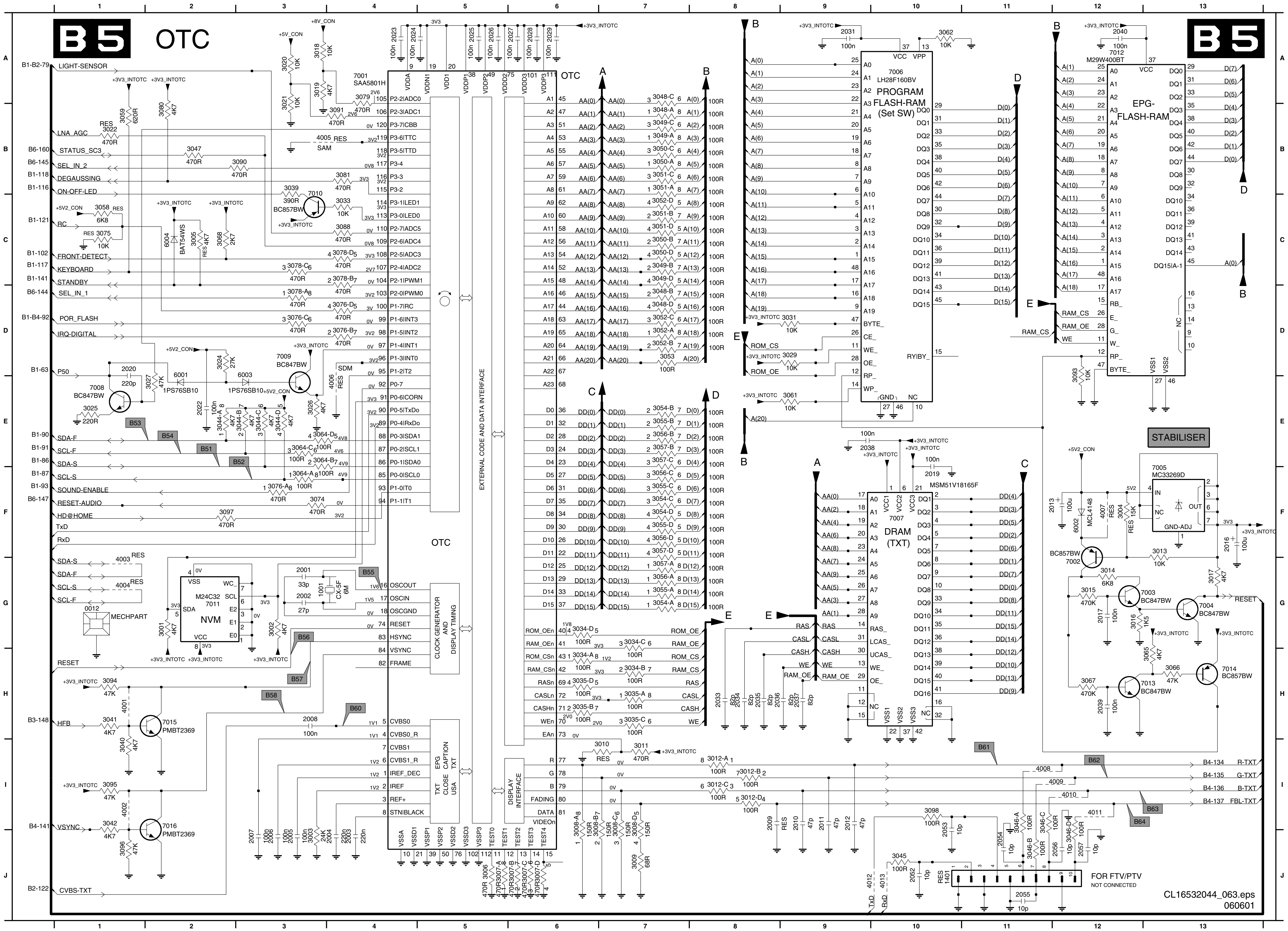
## Small Signal Board: HOP



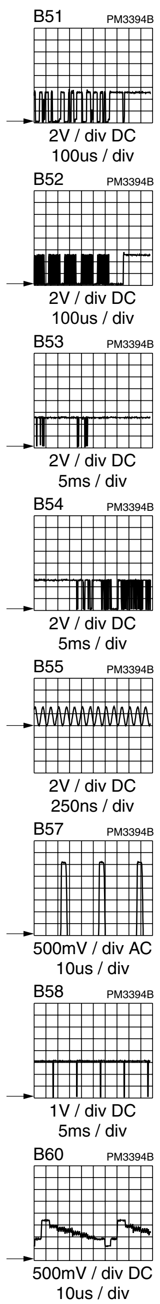

0011 I10
1301 G4
1304 H3
2301 C2
2303 E9
2304 H6
2306 H9
2307 F3
2308 G9
2309 D3
2310 E3
2311 H5
2312 E11
2313 F8
2314 E1
2315 E2
2317 E2
2318 E3
2319 F10
2320 G3
2321 C3
2322 C3
2323 B3
2324 H6
2325 G5
2328 B7
2329 B6
2330 B6
2331 B6
2332 E2
2333 D10
2334 E8
2336 E8
2340 I11
2341 E1
2342 A9
2343 B8
2344 H2
2345 H2
2346 H2
2347 I2
2348 I2
2349 I2
2363 F3
2371 D12
2386 F11
2392 G11
2395 D3
2396 D2
2397 D3
2398 A2
2399 B10
3304 I11
3305 C2
3306 E8
3307 E9
3308 E9
3310 E9
3311 H6
3312 E11
3313 E11
3314 H7
3315 G8
3316 H9
3317 G9
3318 F9
3319 E12
3320 D3
3321 E3
3322 D11
3323 H5
3324 I5
3326 G5
3327 G5
3328 F8
3329 E1
3331 G3
3333 G3
3334 H4
3336 G6
3337 H6
3338 G6
3339 C3
3340 B9
3341 C9
3342 C9
3343 D10
3344 D10
3345 D8
3346 C9
3347 D9
3348 D9
3349 F2
3351 A9
3352 A8
3353 A10
3354 A10
3355 B8
3356 B10
3357 B9
3358 A11
3359 B8
3360 B9
3361 I7
3362 F11
3363 F3
3364 F10
3365 F12
3366 F9
3367 F10
3370 D12
3371 D12
3386 F11
3387 G2
3388 B11
3390 D9
3391 G11
3394 E8
3395 C3
3396 D2
3397 D2
3398 D2
3399 B12
3453 C2
3454 B1
3455 C1
3459 B11
4301 C3
4302 A3
4303 A3
4304 A3
5301 E2
5302 E2
5303 H2
5304 H2
5305 H2
5306 I2
5307 I2
5308 I2
6301 E12
6303 G8
6304 G8
6306 I5
6307 I5
6308 C2
6309 D10
6310 D9
6311 D10
6312 G7
6313 H8
6314 H8
6319 D8
6334 H4
6370 D11
7301 B4
7302 A1
7303 G7
7304 F2
7311 F11
7312 G12
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7340 B12
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C001 H12
c003 I6
c200 F1



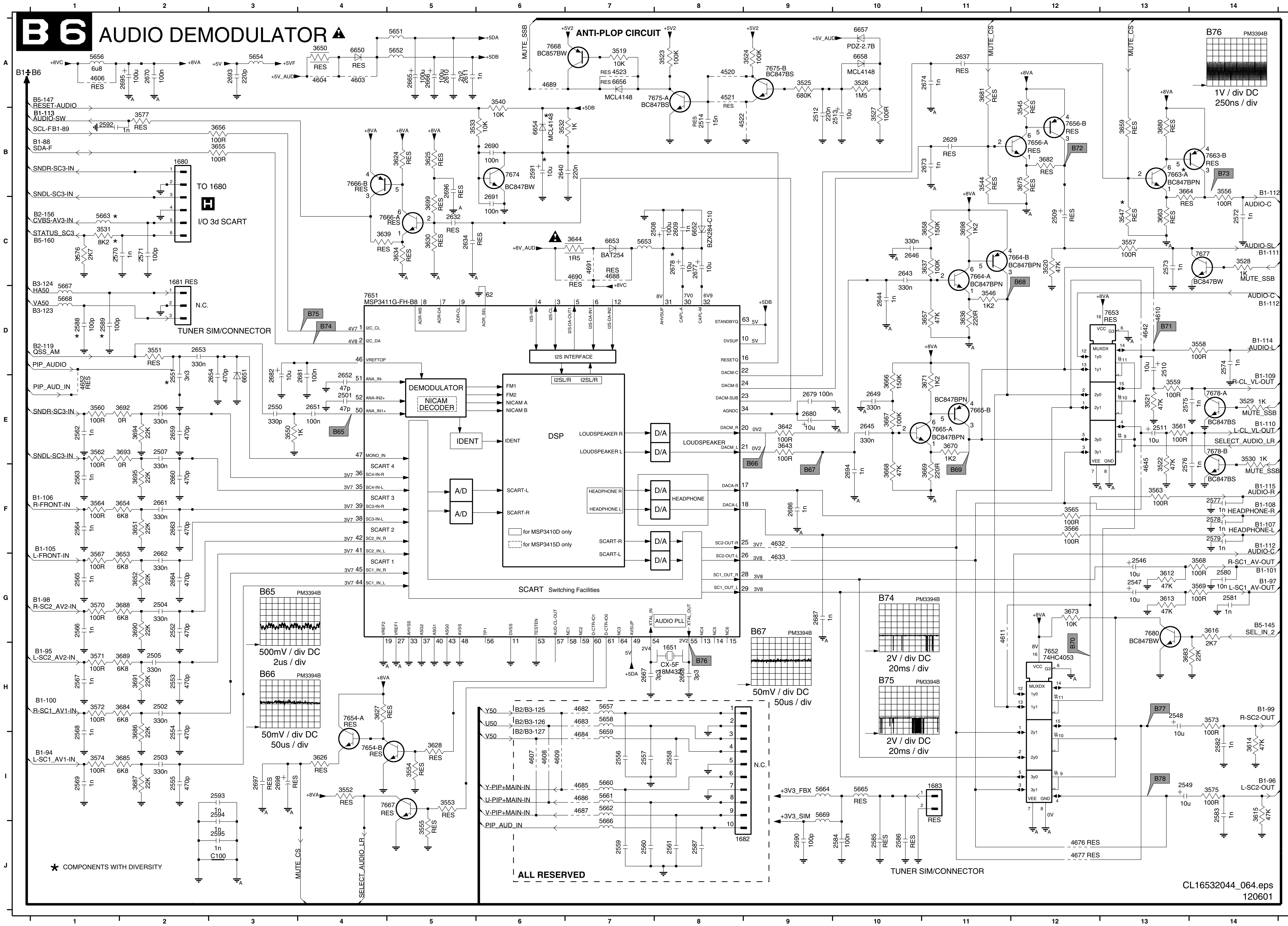
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0012 G1
1001 G3
1401 J10
2001 G3
2002 G3
2003 J4
2004 J4
2005 J3
2006 J3
2007 J3
2008 H3
2009 I8
2010 I9
2011 I9
2012 I9
2013 F12
2016 F13
2017 G12
2019 F10
2020 D1
2022 E2
2023 A4
2024 A4
2025 A5
2026 A5
2027 A6
2028 A6
2029 A6
2031 A9
2033 H8
2034 H8
2035 H8
2036 H8
2037 H9
2038 E9
2039 H12
2040 A12
2052 J10
2053 I10
2054 J11
2055 J11
2056 J12
2057 J12
3001 G2
3002 G3
3003 J3
3004 F12
3005 C2
3006 J5
3007-A J5
3007-B J6
3007-C J6
3007-D J6
3008-A I6
3008-B I6
3008-C I7
3008-D I7
3009 J7
3010 I7
3011 I7
3012-A I8
3012-B I8
3012-C I8
3012-D I8
3013 F13
3014 G12
3015 G12
3016 G12
3017 G13
3018 A3
3019 A3
3020 A3
3021 A3
3022 B1
3024 D2
3025 E1
3026 E3
3027 E2
3029 D9
3031 D9
3033 C4
3034-A H6
3034-B H7
3034-C G7
3034-D G6
3035-A H7
3035-B H6
3035-C H7
3035-D H6
3039 B3
3040 I1
3041 H1
3042 I1
3044-A E2
3044-B E3
3044-C E3
3044-D E3
3045 J10
3046-A I11
3046-B J11
3046-C I11
3046-D J12
3047 B2
3048-A B7
3048-B D7
3048-C A7
3048-D D7
3049-A B7
3049-B C7
3049-C B7
3049-D C7
3050-A B7
3050-B C7
3050-C B7
3050-D C7
3051-A B7
3051-B C7
3051-C B7
3051-D C7
3052-A D7
3052-B D7
3052-C D7
3052-D C7
3053 D7
3054-A G7
3054-B E7
3054-C F7
3054-D F7
3055-A G7
3055-B E7
3055-C F7
3055-D F7
3056-A G7
3056-B E7
3056-C F7
3056-D F7
3057-A G7
3057-B E7
3057-C E7
3057-D F7
3058 C1
3059 B1
3061 E9
3062 A10
3064-A F3
3064-B E3
3064-C E3
3064-D E3
3065 H13
3066 H13
3067 H12
3068 C2
3074 F3
3075 C1
3076-A F3
3076-B D4
3076-C D3
3076-D D4
3078-A D3
3078-B C4
3078-C C3
3078-D C4
3079 A4
3080 B2
3081 B4
3088 C4
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3091 B4
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3098 I10
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4002 I1
4003 G1
4004 G1
4005 B3
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4007 F12
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4009 I12
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4011 I12
4012 J10
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6001 E2
6002 F12
6003 E3
6004 C2
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7003 G12
7004 G13
7005 F13
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7014 H13
7015 H2
7016 I2



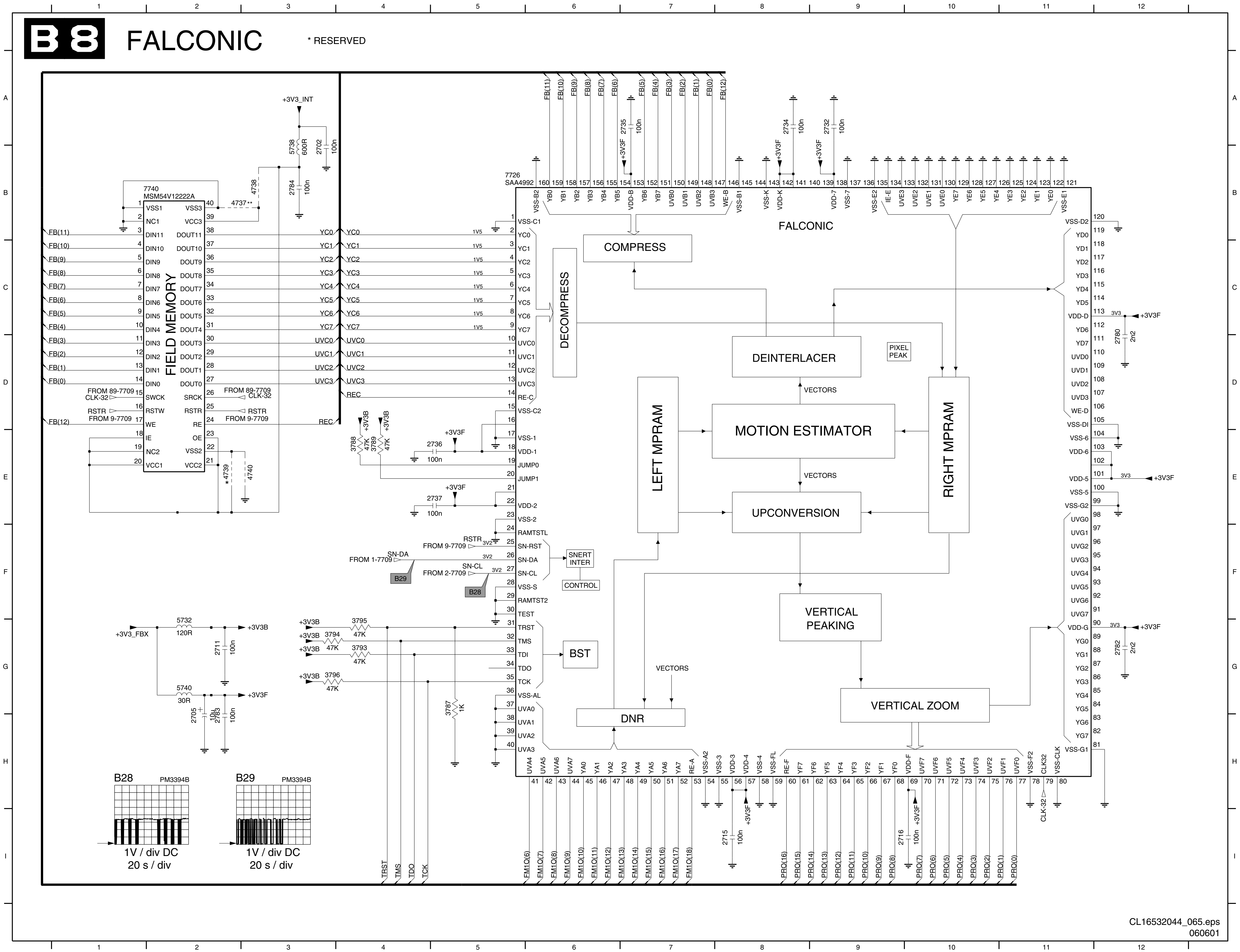
## Small Signal Board: Audio Demodulator




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1651 H8
1680 B2
1681 C2
1682 H8
1683 I11
2501 E4
2502 H2
2503 I2
2504 G2
2505 H2
2506 E2
2507 E2
2508 C8
2509 C12
2510 D13
2511 E13
2512 B9
2513 B10
2514 B8
2546 G13
2547 G13
2548 H13
2549 I13
2550 E3
2551 E2
2552 G2
2553 H2
2554 I2
2555 I2
2556 I7
2557 I7
2558 I8
2559 J7
2560 J7
2561 J8
2562 E1
2563 F1
2564 F1
2565 G1
2566 G1
2567 H1
2568 I1
2569 I1
2570 C1
2571 C2
2572 C14
2573 C13
2574 D14
2575 E13
2576 F13
2577 F14
2578 F14
2579 F14
2580 G14
2581 G14
2582 I14
2583 I14
2584 J10
2585 J10
2586 J10
2587 J8
2588 D1
2589 D1
2590 J9
2591 B6
2592 B1
2593 I3
2594 I3
2595 J3
2609 C8
2610 A5
2611 A5
2629 B11
2632 C5
2634 C5
2637 A11
2640 B6
2643 C10
2644 D10
2645 E10
2646 C10
2649 E10
2651 E4
2652 E4
2653 D2
2654 E3
2659 E2
2660 F2
2661 F2
2662 G2
2663 F2
2664 G2
2665 A5
2666 A5
2667 H7
2668 H8
2670 A2
2673 B11
2674 A11
2677 C8
2678 C8
2679 E9
2680 E9
2681 E4
2682 E3
2686 F9
2687 G9
2690 B6
2691 C6
2693 A3
2694 F10
2695 A2
2696 B5
2697 I3
2698 I3
3519 A7
3520 C12
3521 E13
3522 F13
3523 A8
3524 A9
3525 A9
3526 A10
3527 B10
3528 C14
3529 E14
3530 E14
3531 C1
3532 B6
3533 B5
3540 A6
3544 B11
3545 B12
3546 D11
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3550 E3
3551 D2
3552 I4
3553 I5
3554 I5
3555 J5
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3557 C13
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3559 E13
3560 E1
3561 E13
3562 E1
3563 F13
3564 F1
3565 F12
3566 F12
3567 G1
3568 G14
3569 G14
3570 G1
3571 H1
3572 H1
3573 H14
3574 I1
3575 I14
3576 C1
3577 B2
3612 G13
3613 G13
3614 I14
3615 I14
3616 G14
3624 B5
3625 B5
3626 I4
3627 H4
3628 I5
3630 C5
3634 C5
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3637 C11
3639 C4
3642 E9
3643 E9
3644 C7
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3652 G2
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3655 B3
3656 B3
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3671 E11
3673 G12
3675 B12
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3681 A11
3682 B12
3683 H13
3684 H2
3685 I2
3686 I2
3687 I2
3688 G2
3689 H2
3690 G2
3691 H2
3692 E2
3693 E2
3694 E2
3695 F2
3698 C11
3699 C5
4520 A8
4521 A8
4522 B9
4523 A7
4603 A4
4604 A4
4606 A1
4607 I6
4608 I6
4609 I6
4610 D13
4611 G11
4632 F9
4633 G9
4642 D13
4645 F13
4652 E1
4676 J12
4677 J12
4682 H7
4683 H7
4684 I7
4685 I7
4686 I7
4687 I7
4688 C7
4689 A6
4690 C7
4691 C7
5651 A5
5652 A5
5653 C7
5654 A3
5656 A1
5657 H7
5658 H7
5659 I7
5660 I7
5661 I7
5662 I7
5663 C1
5664 I9
5665 I10
5666 J7
5667 D1
5668 D1
5669 I9
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6656 A7
6657 A10
6658 A10
7651 D4
7652 H12
7653 D13
7654-A H4
7654-B I4
7656-A B12
7656-B B12
7663-A B13
7663-B B14
7664-A C11
7664-B C11
7665-A E11
7665-B E11
7666-A C4
7666-B B4
7667 I5
7668 A6
7674 B6
7675-A A8
7675-B A9
7677 C14
7678-A E14
7678-B E14
7680 G13
C100 J3

## Small Signal Board: Falconic



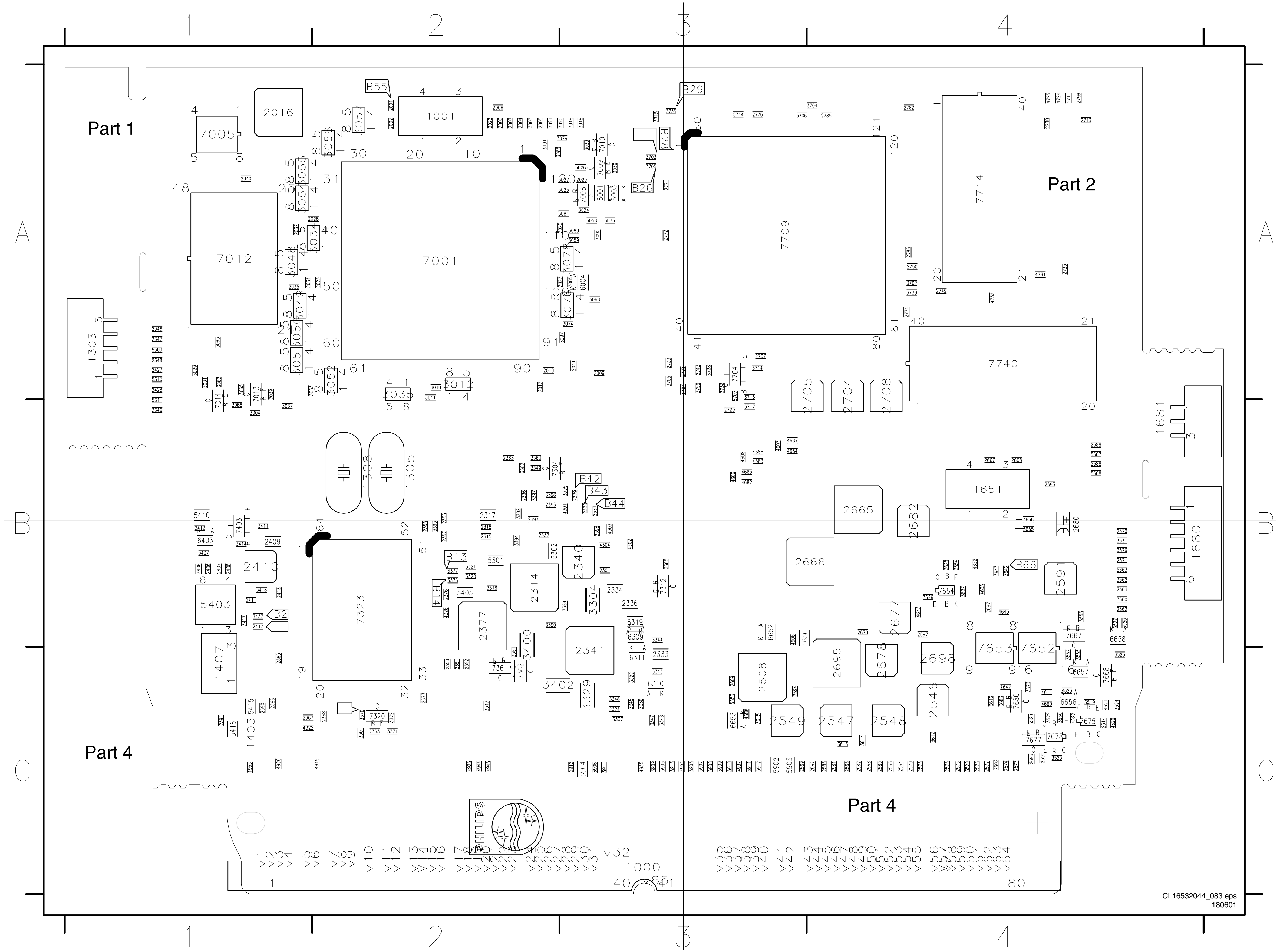

2702 B3
2705 H2
2711 G2
2715 I8
2716 I9
2732 A9
2734 A8
2735 A7
2736 E5
2737 E5
2780 D12
2782 G12
2783 H2
2784 B3
3787 G5
3788 E4
3789 E4
3793 G4
3794 G3
3795 G4
3796 G3
4737 B2
4738 B3
4739 E2
4740 E3
5732 G2
5738 B3
5740 G2
7726 B5
7740 B1

## Layout SSB (LOT Side Overview)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1000 | C3 | 1308 | B2 | 1680 | B4 | 2004 | A2 | 2008 | A2 | 2012 | A2 | 2025 | A2 | 2034 | A1 | 2040 | A1 | 2317 | B2 |
| 1001 | A2 | 1403 | C1 | 1681 | B4 | 2005 | A2 | 2009 | A3 | 2016 | A1 | 2027 | A3 | 2035 | A1 | 2301 | B3 | 2318 | B2 |
| 1303 | A1 | 1407 | C1 | 2001 | A2 | 2006 | A2 | 2010 | A2 | 2020 | A3 | 2028 | A2 | 2037 | A1 | 2314 | B2 | 2324 | C3 |
| 1305 | B2 | 1651 | B4 | 2002 | A2 | 2007 | A2 | 2011 | A3 | 2023 | A2 | 2029 | A3 | 2039 | A1 | 2315 | B2 | 2329 | B3 |

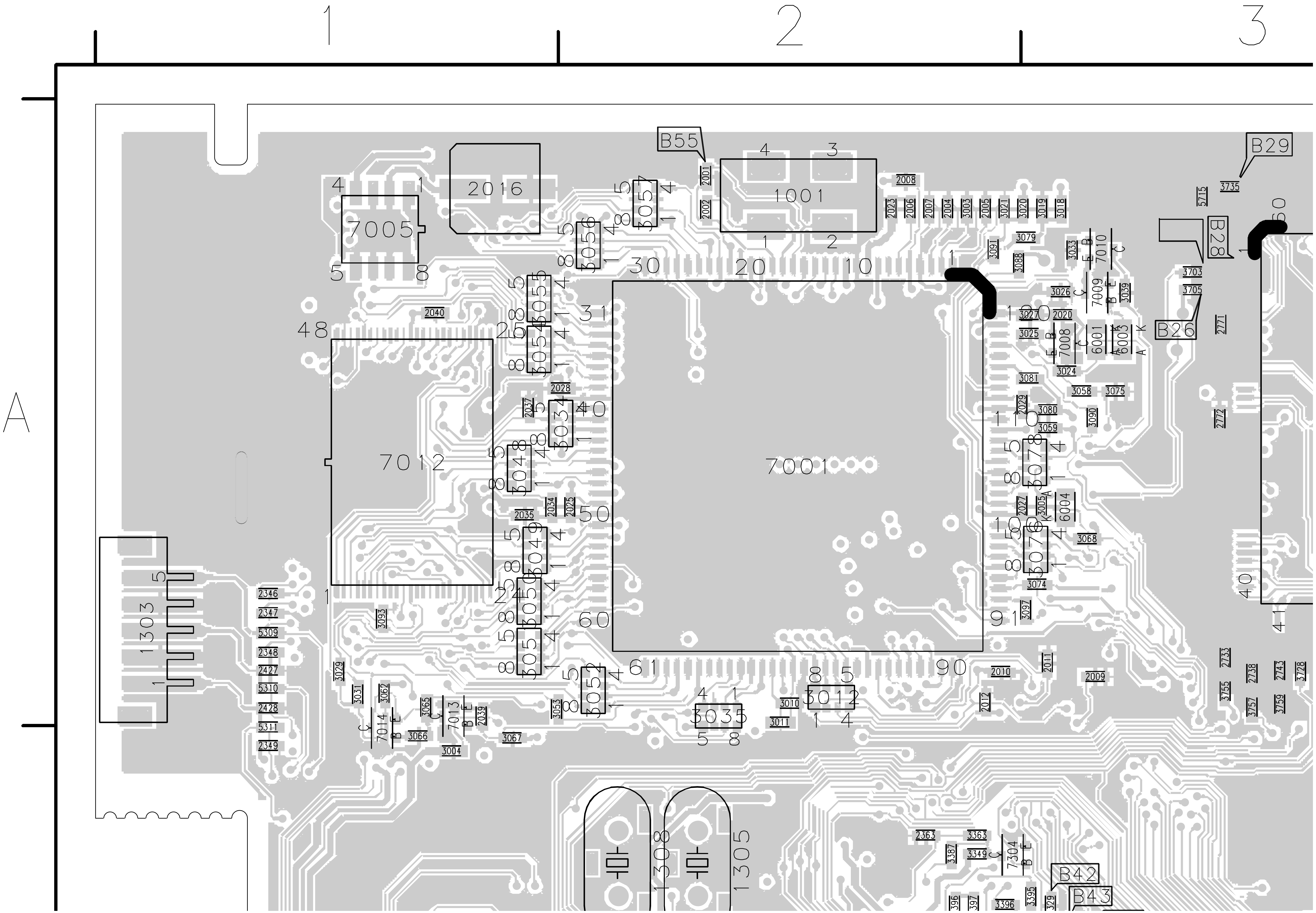
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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2330 | B3 | 2334 | B3 | 2346 | A1 | 2350 | C2 | 2356 | B2 | 2365 | C1 | 2373 | C2 | 2391 | C1 | 2398 | B3 | 2409 | B1 |
| 2331 | B3 | 2336 | B3 | 2347 | A1 | 2351 | C2 | 2357 | B2 | 2366 | C1 | 2376 | B2 | 2395 | B2 | 2406 | B1 | 2410 | B1 |
| 2332 | B2 | 2340 | B3 | 2348 | A1 | 2352 | C2 | 2358 | B2 | 2367 | C1 | 2377 | B2 | 2396 | B2 | 2407 | B1 | 2411 | B1 |
| 2333 | C3 | 2341 | B3 | 2349 | B1 | 2353 | C2 | 2363 | B2 | 2368 | C2 | 2390 | C1 | 2397 | B2 | 2408 | B1 | 2412 | B1 |

| | |
|---|---|
| 2417 | B1 |
| 2418 | B1 |
| 2427 | A1 |
| 2428 | A1 |

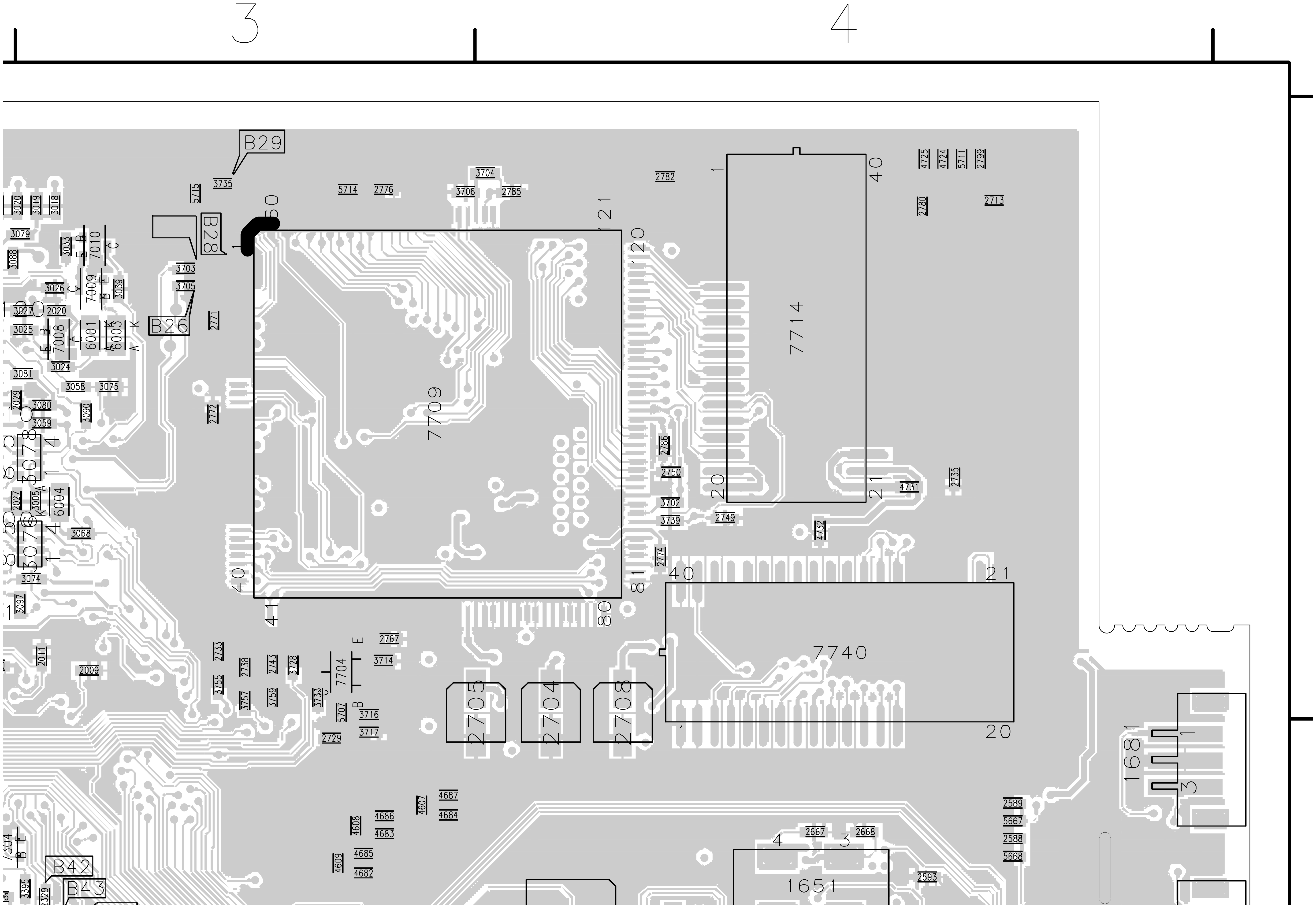



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2508 | C3 | 3062 | A1 | 3757 | A3 | 7362 | C2 |
| 2514 | C4 | 3065 | A1 | 3759 | A3 | 7403 | B1 |
| 2546 | C4 | 3066 | B1 | 3906 | C3 | 7652 | B4 |
| 2547 | C4 | 3067 | B1 | 3909 | C3 | 7653 | B4 |
| 2548 | C4 | 3068 | A3 | 3911 | C3 | 7654 | B4 |
| 2549 | C3 | 3074 | A3 | 4301 | B3 | 7667 | B4 |
| 2562 | B4 | 3075 | A3 | 4302 | B3 | 7668 | C4 |
| 2563 | B4 | 3076 | A3 | 4303 | B3 | 7675 | C4 |
| 2564 | C4 | 3078 | A2 | 4304 | B3 | 7677 | C4 |
| 2565 | C4 | 3079 | A3 | 4322 | C1 | 7678 | C4 |
| 2566 | C4 | 3080 | A3 | 4326 | B2 | 7680 | C4 |
| 2567 | C4 | 3081 | A3 | 4520 | C4 | 7704 | A3 |
| 2568 | C4 | 3088 | A2 | 4521 | C4 | 7709 | A3 |
| 2569 | C3 | 3090 | A3 | 4522 | C4 | 7714 | A4 |
| 2570 | B4 | 3091 | A2 | 4523 | C4 | 7740 | A4 |
| 2571 | B4 | 3093 | A1 | 4606 | B3 | | |
| 2572 | C4 | 3097 | A3 | 4607 | B3 | | |
| 2573 | C4 | 3301 | C2 | 4608 | B3 | | |
| 2574 | C4 | 3304 | B3 | 4609 | B3 | | |
| 2575 | C4 | 3317 | C2 | 4611 | C4 | | |
| 2576 | C4 | 3318 | B2 | 4632 | B4 | | |
| 2577 | C4 | 3320 | B2 | 4633 | B4 | | |
| 2578 | C4 | 3321 | B2 | 4642 | C4 | | |
| 2579 | C4 | 3322 | C3 | 4645 | B4 | | |
| 2580 | C4 | 3329 | C3 | 4677 | B4 | | |
| 2581 | C4 | 3336 | C3 | 4682 | B3 | | |
| 2582 | C4 | 3337 | C3 | 4683 | B3 | | |
| 2583 | C4 | 3343 | C3 | 4684 | B3 | | |
| 2588 | B4 | 3344 | B3 | 4685 | B3 | | |
| 2589 | B4 | 3345 | C3 | 4686 | B3 | | |
| 2590 | C4 | 3346 | C3 | 4687 | B3 | | |
| 2591 | B4 | 3347 | C3 | 4688 | C3 | | |
| 2592 | C4 | 3348 | C3 | 4689 | C4 | | |
| 2593 | B4 | 3349 | B2 | 4724 | A4 | | |
| 2594 | C3 | 3361 | C2 | 4725 | A4 | | |
| 2609 | C3 | 3363 | B2 | 4731 | A4 | | |
| 2665 | B4 | 3364 | B3 | 4732 | A4 | | |
| 2666 | B3 | 3365 | B3 | 4919 | C2 | | |
| 2667 | B4 | 3370 | C2 | 4920 | C1 | | |
| 2668 | B4 | 3371 | C2 | 4925 | C2 | | |
| 2670 | B4 | 3372 | C2 | 4935 | C3 | | |
| 2677 | B4 | 3376 | B2 | 4937 | C3 | | |
| 2678 | C4 | 3377 | B2 | 4944 | C2 | | |
| 2680 | B4 | 3387 | B2 | 4945 | C2 | | |
| 2682 | B4 | 3390 | B2 | 4953 | C1 | | |
| 2687 | B4 | 3393 | B2 | 4954 | C3 | | |
| 2693 | C4 | 3394 | B2 | 5301 | B2 | | |
| 2695 | B4 | 3395 | B3 | 5302 | B2 | | |
| 2697 | B4 | 3396 | B2 | 5309 | A1 | | |
| 2698 | B4 | 3397 | B2 | 5310 | A1 | | |
| 2704 | A4 | 3398 | B2 | 5311 | B1 | | |
| 2705 | A3 | 3400 | B2 | 5403 | B1 | | |
| 2708 | A4 | 3402 | C2 | 5405 | B2 | | |
| 2713 | A4 | 3406 | B1 | 5407 | B1 | | |
| 2729 | B3 | 3411 | B1 | 5410 | B1 | | |
| 2733 | A3 | 3414 | B1 | 5415 | C1 | | |
| 2735 | A4 | 3417 | B1 | 5416 | C1 | | |
| 2738 | A3 | 3418 | B1 | 5653 | C3 | | |
| 2743 | A3 | 3437 | B1 | 5656 | B3 | | |
| 2749 | A4 | 3519 | C4 | 5663 | B4 | | |
| 2750 | A4 | 3520 | C4 | 5667 | B4 | | |
| 2767 | A3 | 3523 | C4 | 5668 | B4 | | |
| 2771 | A3 | 3524 | C4 | 5707 | A3 | | |
| 2772 | A3 | 3525 | C4 | 5711 | A4 | | |
| 2774 | A4 | 3526 | B4 | 5714 | A3 | | |
| 2776 | A3 | 3527 | B4 | 5715 | A3 | | |
| 2780 | A4 | 3528 | C4 | 5902 | C3 | | |
| 2782 | A4 | 3529 | C4 | 5903 | C3 | | |
| 2785 | A4 | 3530 | C4 | 5904 | C3 | | |
| 2786 | A4 | 3531 | B4 | 5905 | C3 | | |
| 2799 | A4 | 3552 | C4 | 5906 | C3 | | |
| 2912 | C3 | 3553 | B4 | 5907 | C3 | | |
| 3003 | A2 | 3554 | B4 | 5908 | C3 | | |
| 3004 | B1 | 3555 | C4 | 5909 | C3 | | |
| 3005 | A3 | 3560 | B4 | 5910 | C3 | | |
| 3010 | A2 | 3562 | B4 | 5911 | C3 | | |
| 3011 | A2 | 3576 | B4 | 5912 | C3 | | |
| 3012 | A2 | 3612 | C4 | 5913 | C3 | | |
| 3018 | A3 | 3613 | C4 | 6001 | A3 | | |
| 3019 | A3 | 3614 | C4 | 6003 | A3 | | |
| 3020 | A3 | 3615 | C3 | 6004 | A3 | | |
| 3021 | A2 | 3616 | C4 | 6309 | B3 | | |
| 3024 | A3 | 3626 | B4 | 6310 | C3 | | |
| 3025 | A3 | 3627 | B4 | 6311 | C3 | | |
| 3026 | A3 | 3628 | B4 | 6319 | B3 | | |
| 3027 | A3 | 3642 | B4 | 6403 | B1 | | |
| 3029 | A1 | 3643 | B4 | 6652 | B3 | | |
| 3031 | A1 | 3655 | B4 | 6653 | C3 | | |
| 3033 | A3 | 3656 | B4 | 6656 | C4 | | |
| 3034 | A2 | 3673 | C4 | 6657 | C4 | | |
| 3035 | A2 | 3683 | C4 | 6658 | B4 | | |
| 3039 | A3 | 3702 | A4 | 7001 | A2 | | |
| 3048 | A1 | 3703 | A3 | 7005 | A1 | | |
| 3049 | A1 | 3704 | A4 | 7008 | A3 | | |
| 3050 | A1 | 3705 | A3 | 7009 | A3 | | |
| 3051 | A1 | 3706 | A3 | 7010 | A3 | | |
| 3052 | A2 | 3714 | A3 | 7012 | A1 | | |
| 3053 | A1 | 3716 | A3 | 7013 | A1 | | |
| 3054 | A1 | 3717 | B3 | 7014 | B1 | | |
| 3055 | A1 | 3728 | A3 | 7304 | B3 | | |
| 3056 | A1 | 3733 | A3 | 7312 | B3 | | |
| 3057 | A2 | 3735 | A3 | 7320 | C2 | | |
| 3058 | A3 | 3739 | A4 | 7323 | B2 | | |
| 3059 | A3 | 3755 | A3 | 7361 | C2 | | |

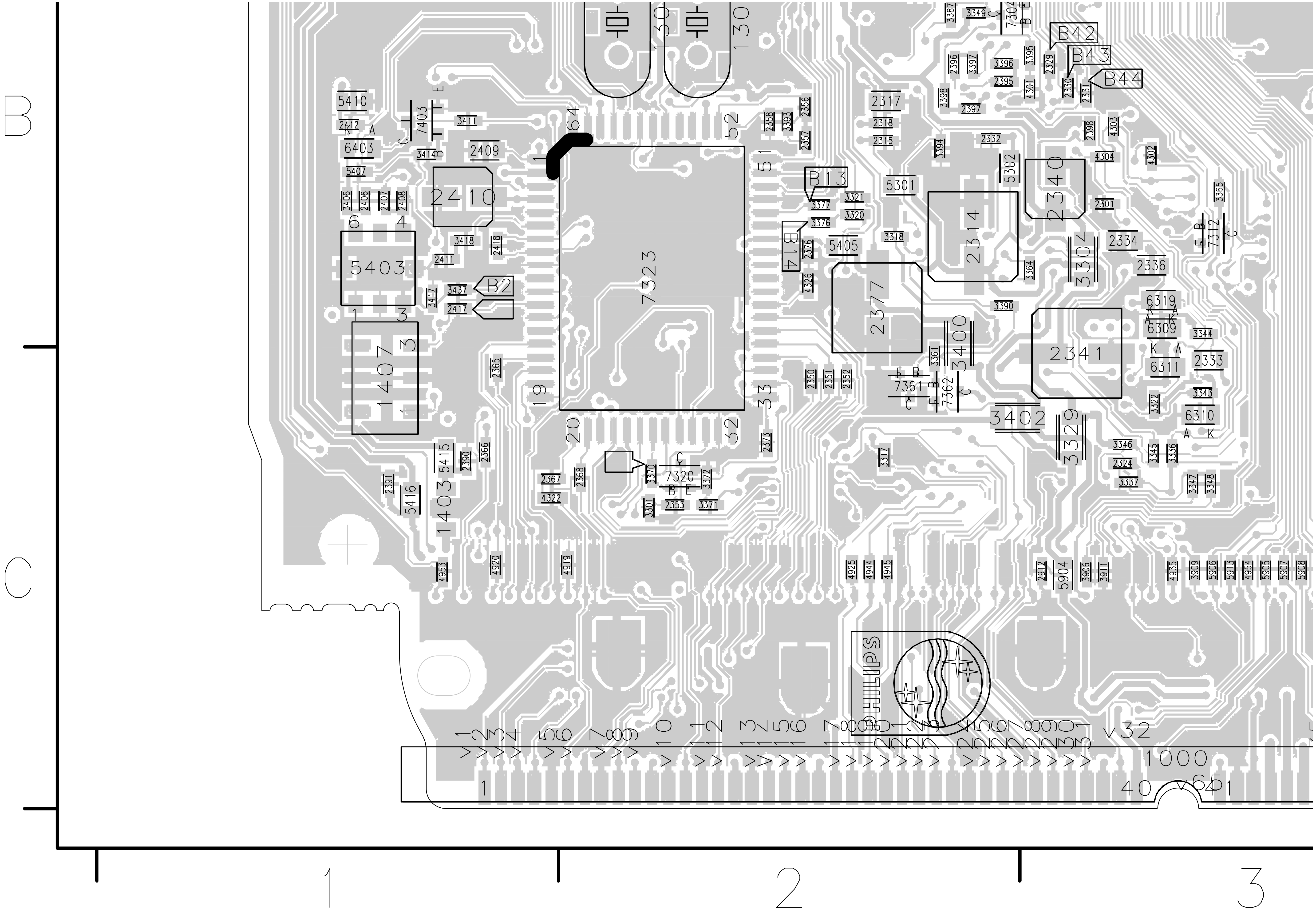
**SSB (LOT Side Part 1)**



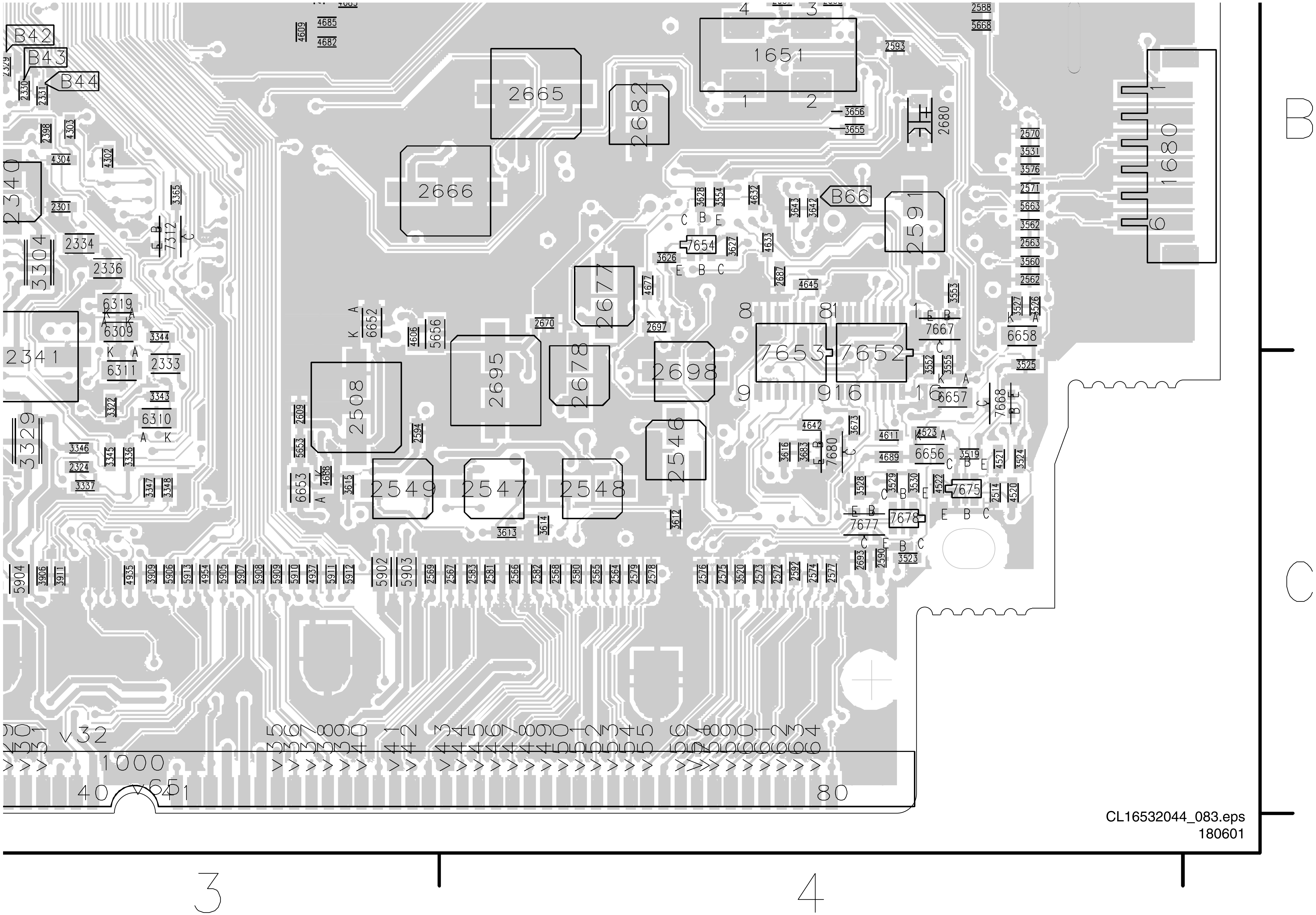
**SSB (LOT Side Part 2)**



**SSB (LOT Side Part 3)**



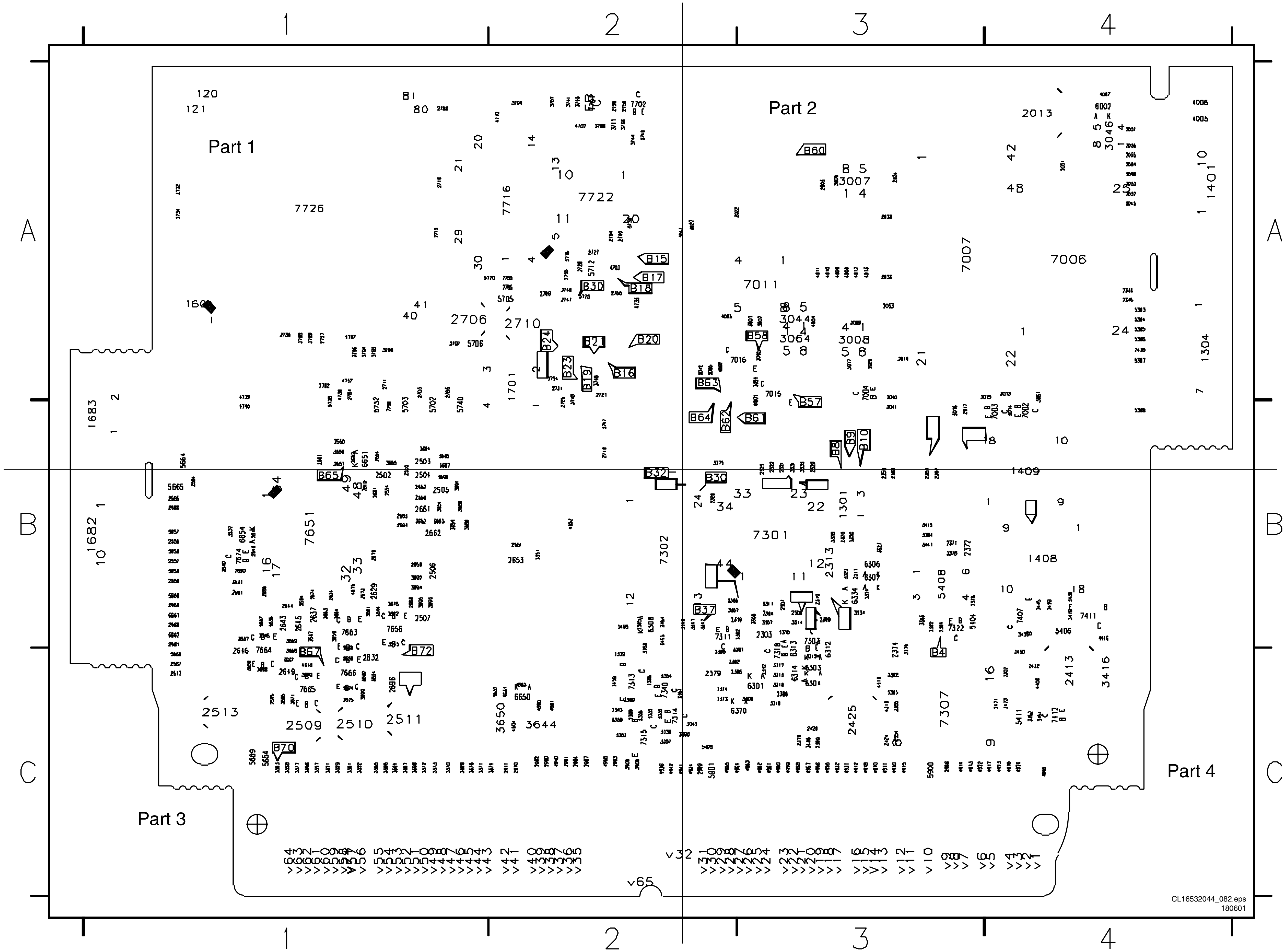
**SSB (LOT Side Part 4)**



CL16532044_083.eps
180601

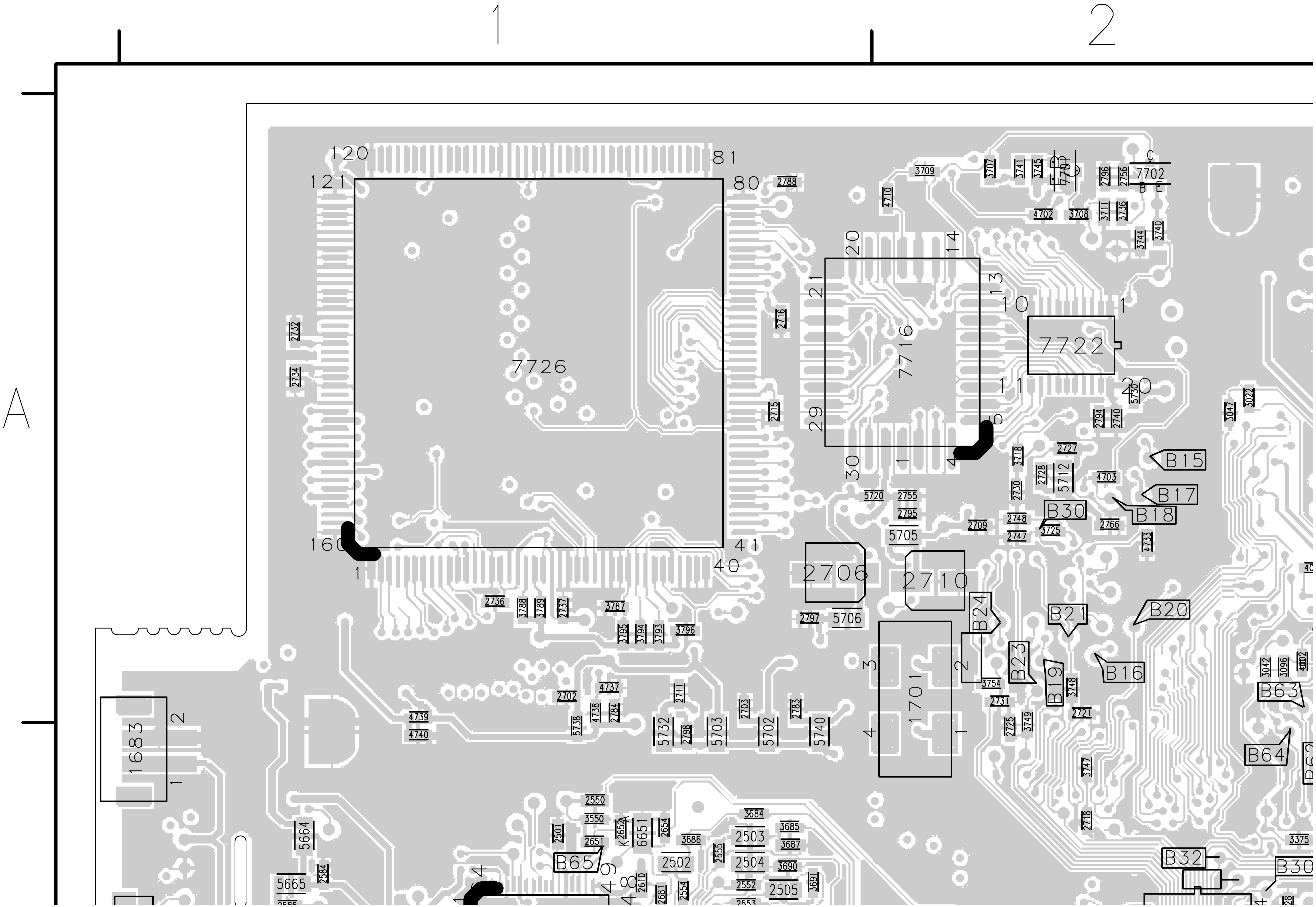
## SSB (Tuner Side Overview)

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1301 | B3 | 1409 | B4 | 2003 | A3 | 2022 | A2 | 2033 | A3 | 2053 | A4 | 2057 | A4 | 2306 | C3 | 2310 | B3 | 2319 | B3 | 2323 | B3 | 2343 | C2 | 2359 | B3 | 2369 | C3 | 2374 | C3 | 2384 | B3 | 2399 | C2 | 2422 | C4 | 2426 | A4 | 2504 | B1 | 2509 | C1 |
| 1304 | A4 | 1682 | B1 | 2013 | A4 | 2024 | A3 | 2036 | A3 | 2054 | A4 | 2302 | C4 | 2307 | B3 | 2311 | B3 | 2320 | B3 | 2325 | B3 | 2344 | A4 | 2360 | B3 | 2370 | C3 | 2375 | C3 | 2385 | C3 | 2413 | C4 | 2423 | C4 | 2501 | B1 | 2505 | B1 | 2510 | C1 |
| 1401 | A4 | 1683 | B1 | 2017 | B3 | 2026 | A3 | 2038 | A3 | 2055 | A4 | 2303 | B3 | 2308 | B3 | 2312 | C3 | 2321 | B3 | 2328 | B2 | 2345 | A4 | 2361 | B3 | 2371 | B3 | 2378 | B3 | 2386 | C3 | 2420 | C3 | 2424 | C3 | 2502 | B1 | 2506 | B1 | 2511 | C1 |
| 1408 | B4 | 1701 | A1 | 2019 | A3 | 2031 | A4 | 2052 | A4 | 2056 | A4 | 2304 | B3 | 2309 | B3 | 2313 | B3 | 2322 | B3 | 2342 | C2 | 2354 | C3 | 2362 | B3 | 2372 | B3 | 2379 | C2 | 2392 | C2 | 2421 | C4 | 2425 | C3 | 2503 | B1 | 2507 | B1 | 2512 | C1 |

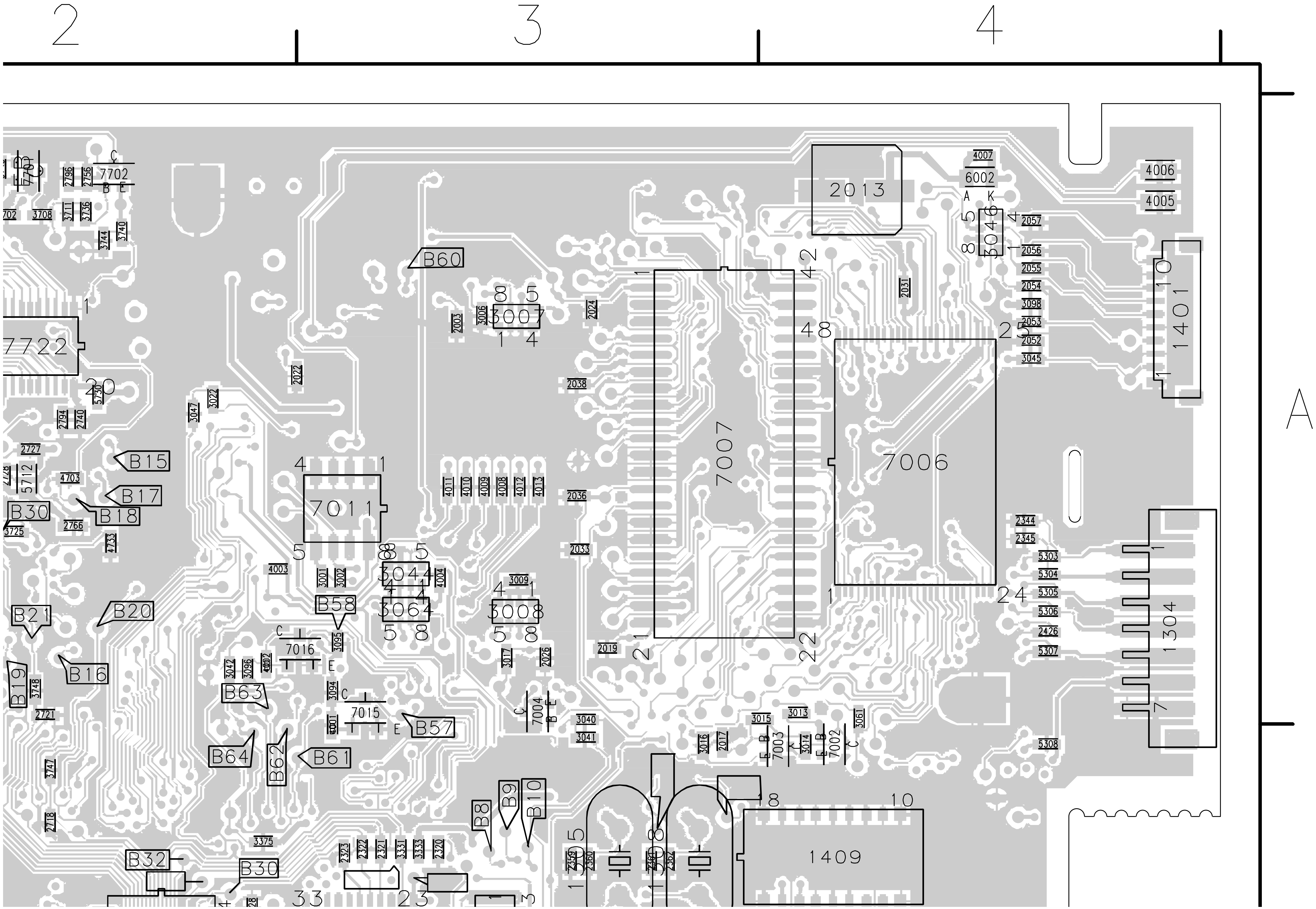



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2513 | C1 | 3042 | A2 | 3624 | C1 | 4926 | C3 |
| 2550 | B1 | 3044 | A3 | 3625 | C1 | 4930 | C3 |
| 2551 | B2 | 3045 | A4 | 3630 | C1 | 4931 | C3 |
| 2552 | B1 | 3046 | A4 | 3634 | C1 | 4932 | C3 |
| 2553 | B1 | 3047 | A2 | 3636 | B1 | 4934 | C2 |
| 2554 | B1 | 3061 | A4 | 3637 | B1 | 4936 | C2 |
| 2555 | B1 | 3064 | A3 | 3639 | C1 | 4940 | C2 |
| 2556 | B1 | 3094 | A3 | 3644 | C2 | 4941 | C2 |
| 2557 | B1 | 3095 | A3 | 3650 | C2 | 4942 | C2 |
| 2558 | B1 | 3096 | A2 | 3651 | B1 | 4955 | C2 |
| 2559 | B1 | 3098 | A4 | 3652 | B1 | 4956 | C3 |
| 2560 | B1 | 3302 | C3 | 3653 | B1 | 4957 | C3 |
| 2561 | B1 | 3303 | C3 | 3654 | B1 | 4958 | C3 |
| 2584 | B1 | 3305 | B2 | 3657 | B1 | 4959 | C3 |
| 2585 | B1 | 3306 | B3 | 3658 | C1 | 4960 | C3 |
| 2586 | B1 | 3307 | B3 | 3659 | B1 | 4961 | C3 |
| 2587 | C1 | 3308 | C3 | 3663 | B1 | 4962 | C3 |
| 2595 | C1 | 3310 | B3 | 3664 | B1 | 4963 | C3 |
| 2610 | B1 | 3311 | B3 | 3666 | C1 | 4964 | C3 |
| 2611 | B1 | 3312 | C3 | 3667 | C1 | 4965 | C4 |
| 2629 | B1 | 3313 | C3 | 3668 | C1 | 4966 | C2 |
| 2632 | C1 | 3314 | B3 | 3669 | B1 | 5303 | A4 |
| 2634 | B1 | 3315 | C3 | 3670 | C1 | 5304 | A4 |
| 2637 | B1 | 3316 | C3 | 3671 | C1 | 5305 | A4 |
| 2640 | B1 | 3319 | C3 | 3675 | B1 | 5306 | A4 |
| 2643 | B1 | 3323 | B3 | 3680 | B1 | 5307 | A4 |
| 2644 | B1 | 3324 | B3 | 3681 | B1 | 5308 | B4 |
| 2645 | B1 | 3326 | B3 | 3682 | B1 | 5404 | B3 |
| 2646 | C1 | 3327 | B3 | 3684 | B1 | 5406 | B4 |
| 2649 | C1 | 3328 | B3 | 3685 | B1 | 5408 | B3 |
| 2651 | B1 | 3331 | B3 | 3686 | B1 | 5409 | C2 |
| 2652 | B1 | 3333 | B3 | 3687 | B1 | 5411 | C4 |
| 2653 | B2 | 3334 | B3 | 3688 | B1 | 5651 | C2 |
| 2654 | B1 | 3338 | C2 | 3689 | B1 | 5652 | C2 |
| 2659 | B1 | 3339 | C2 | 3690 | B1 | 5654 | C1 |
| 2660 | B1 | 3340 | B2 | 3691 | B1 | 5657 | B1 |
| 2661 | B1 | 3341 | B2 | 3692 | B1 | 5658 | B1 |
| 2662 | B1 | 3342 | B2 | 3693 | B1 | 5659 | B1 |
| 2663 | B1 | 3351 | C2 | 3694 | B1 | 5660 | B1 |
| 2664 | B1 | 3352 | C2 | 3695 | B1 | 5661 | B1 |
| 2673 | B1 | 3353 | C2 | 3698 | C1 | 5662 | B1 |
| 2674 | B1 | 3354 | C2 | 3699 | C1 | 5664 | B1 |
| 2679 | B1 | 3355 | C2 | 3707 | A2 | 5665 | B1 |
| 2681 | B1 | 3356 | C2 | 3708 | A2 | 5666 | C1 |
| 2686 | B1 | 3357 | C2 | 3709 | A2 | 5669 | C1 |
| 2690 | B1 | 3358 | C2 | 3711 | A2 | 5702 | B1 |
| 2691 | B1 | 3359 | C2 | 3718 | A2 | 5703 | B1 |
| 2694 | B1 | 3360 | C2 | 3725 | A2 | 5705 | A2 |
| 2696 | C1 | 3362 | B3 | 3736 | A2 | 5706 | A1 |
| 2702 | A1 | 3366 | B2 | 3740 | A2 | 5712 | A2 |
| 2703 | A1 | 3367 | B2 | 3741 | A2 | 5720 | A2 |
| 2706 | A1 | 3373 | C2 | 3744 | A2 | 5730 | A2 |
| 2709 | A2 | 3374 | C2 | 3745 | A2 | 5732 | B1 |
| 2710 | A2 | 3375 | B2 | 3747 | B2 | 5738 | B1 |
| 2711 | A1 | 3378 | B3 | 3748 | A2 | 5740 | B1 |
| 2715 | A1 | 3382 | B3 | 3749 | A2 | 5900 | C3 |
| 2716 | A1 | 3384 | B3 | 3754 | A2 | 5901 | C2 |
| 2718 | B2 | 3385 | B3 | 3787 | A1 | 6002 | A4 |
| 2721 | A2 | 3386 | C2 | 3788 | A1 | 6301 | C3 |
| 2725 | B2 | 3388 | C2 | 3789 | A1 | 6303 | C3 |
| 2727 | A2 | 3391 | C3 | 3793 | A1 | 6304 | C3 |
| 2728 | A2 | 3399 | C2 | 3794 | A1 | 6306 | B3 |
| 2730 | A2 | 3415 | B3 | 3795 | A1 | 6307 | B3 |
| 2731 | A2 | 3416 | C4 | 3796 | A1 | 6308 | B2 |
| 2732 | A1 | 3419 | B4 | 4001 | B3 | 6312 | B3 |
| 2734 | A1 | 3435 | B4 | 4002 | A2 | 6313 | C3 |
| 2736 | A1 | 3436 | B4 | 4003 | A2 | 6314 | C3 |
| 2737 | A1 | 3439 | B4 | 4004 | A3 | 6334 | B3 |
| 2740 | A2 | 3441 | B3 | 4005 | A4 | 6370 | C3 |
| 2747 | A2 | 3445 | B4 | 4006 | A4 | 6650 | C2 |
| 2748 | A2 | 3446 | C3 | 4007 | A4 | 6651 | B1 |
| 2755 | A2 | 3450 | C4 | 4008 | A3 | 6654 | B1 |
| 2756 | A2 | 3451 | C4 | 4009 | A3 | 7002 | B4 |
| 2766 | A2 | 3452 | C4 | 4010 | A3 | 7003 | B4 |
| 2783 | A1 | 3453 | B2 | 4011 | A3 | 7004 | B3 |
| 2784 | A1 | 3454 | B2 | 4012 | A3 | 7006 | A4 |
| 2788 | A1 | 3455 | B2 | 4013 | A3 | 7007 | A3 |
| 2794 | A2 | 3459 | C2 | 4318 | C3 | 7011 | A3 |
| 2795 | A2 | 3521 | C1 | 4319 | C3 | 7015 | B3 |
| 2796 | A2 | 3522 | C1 | 4406 | C4 | 7016 | A3 |
| 2797 | A1 | 3532 | B1 | 4416 | B4 | 7301 | B2 |
| 2798 | B1 | 3533 | B1 | 4603 | C2 | 7302 | B2 |
| 2900 | C2 | 3540 | B1 | 4604 | C2 | 7303 | C3 |
| 2901 | C2 | 3544 | B1 | 4610 | C1 | 7307 | C3 |
| 2902 | C2 | 3545 | B1 | 4652 | B2 | 7311 | B2 |
| 2903 | C2 | 3546 | B1 | 4676 | B1 | 7313 | C2 |
| 2904 | C2 | 3547 | B1 | 4690 | C2 | 7314 | C2 |
| 2905 | C2 | 3550 | B1 | 4691 | C2 | 7315 | C2 |
| 2906 | C2 | 3551 | B2 | 4702 | A2 | 7318 | C3 |
| 2907 | C2 | 3556 | C1 | 4703 | A2 | 7322 | B3 |
| 2908 | C3 | 3557 | C1 | 4710 | A2 | 7340 | C2 |
| 2909 | C2 | 3558 | C1 | 4733 | A2 | 7407 | B4 |
| 2910 | C2 | 3559 | C1 | 4737 | A1 | 7411 | B4 |
| 2911 | C2 | 3561 | C1 | 4738 | A1 | 7412 | C4 |
| 3001 | A3 | 3563 | C1 | 4739 | A1 | 7651 | B1 |
| 3002 | A3 | 3564 | C1 | 4740 | B1 | 7656 | B1 |
| 3006 | A3 | 3565 | C1 | 4910 | C3 | 7663 | B1 |
| 3007 | A3 | 3566 | C1 | 4911 | C3 | 7664 | C1 |
| 3008 | A3 | 3567 | C1 | 4912 | C3 | 7665 | C1 |
| 3009 | A3 | 3568 | C1 | 4913 | C3 | 7666 | C1 |
| 3013 | A4 | 3569 | C1 | 4914 | C3 | 7674 | B1 |
| 3014 | B4 | 3570 | C1 | 4915 | C3 | 7701 | A2 |
| 3015 | A4 | 3571 | C1 | 4916 | C4 | 7702 | A2 |
| 3016 | B3 | 3572 | C1 | 4917 | C4 | 7716 | A2 |
| 3017 | A3 | 3573 | C1 | 4918 | C3 | 7722 | A2 |
| 3022 | A2 | 3574 | C2 | 4922 | C3 | 7726 | A1 |
| 3040 | A3 | 3575 | C1 | 4923 | C4 | | |
| 3041 | B3 | 3577 | C1 | 4924 | C4 | | |

**SSB (Tuner Side Part 1)**



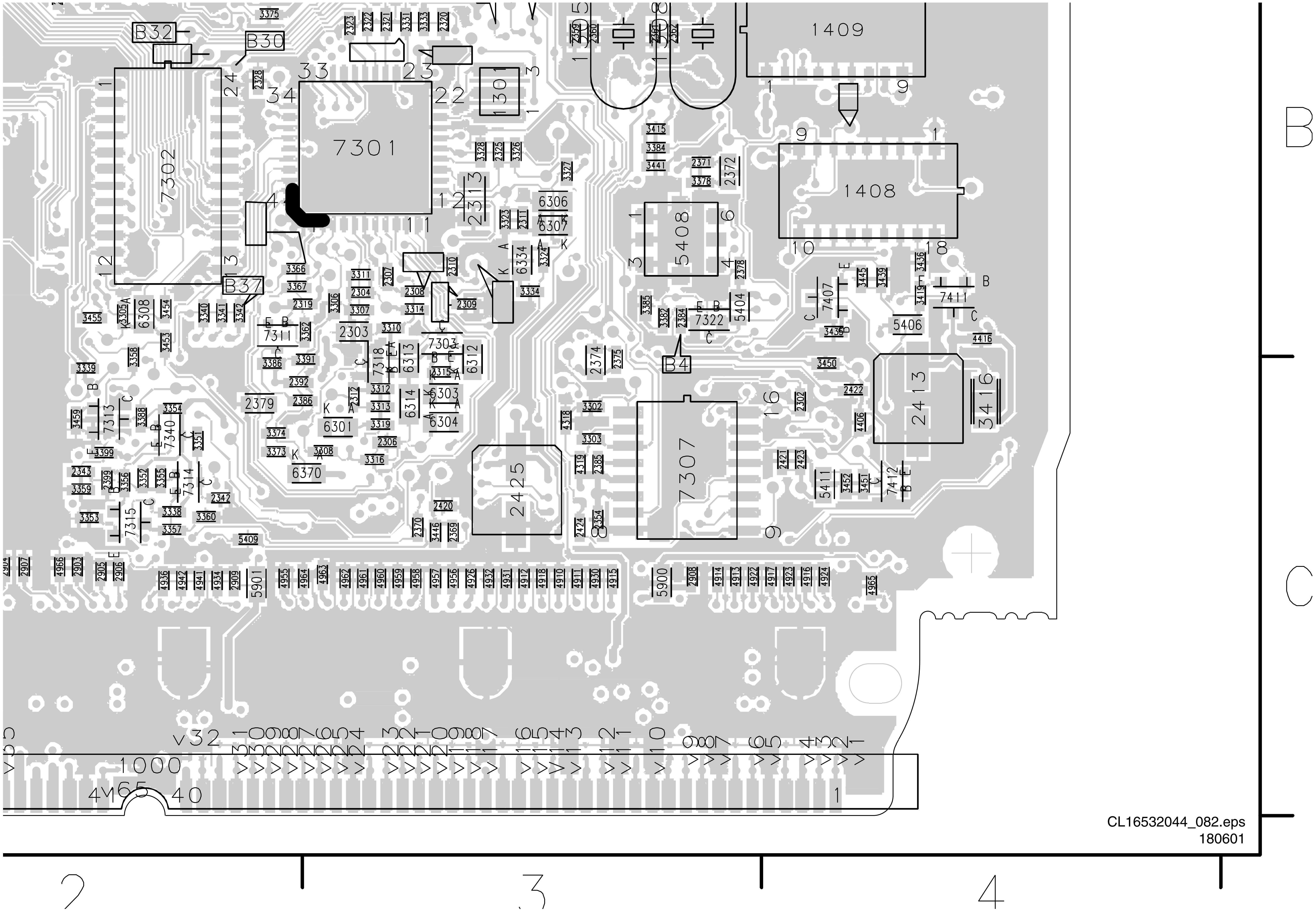
**SSB (Tuner Side Part 2)**



**SSB (Tuner Side Part 3)**

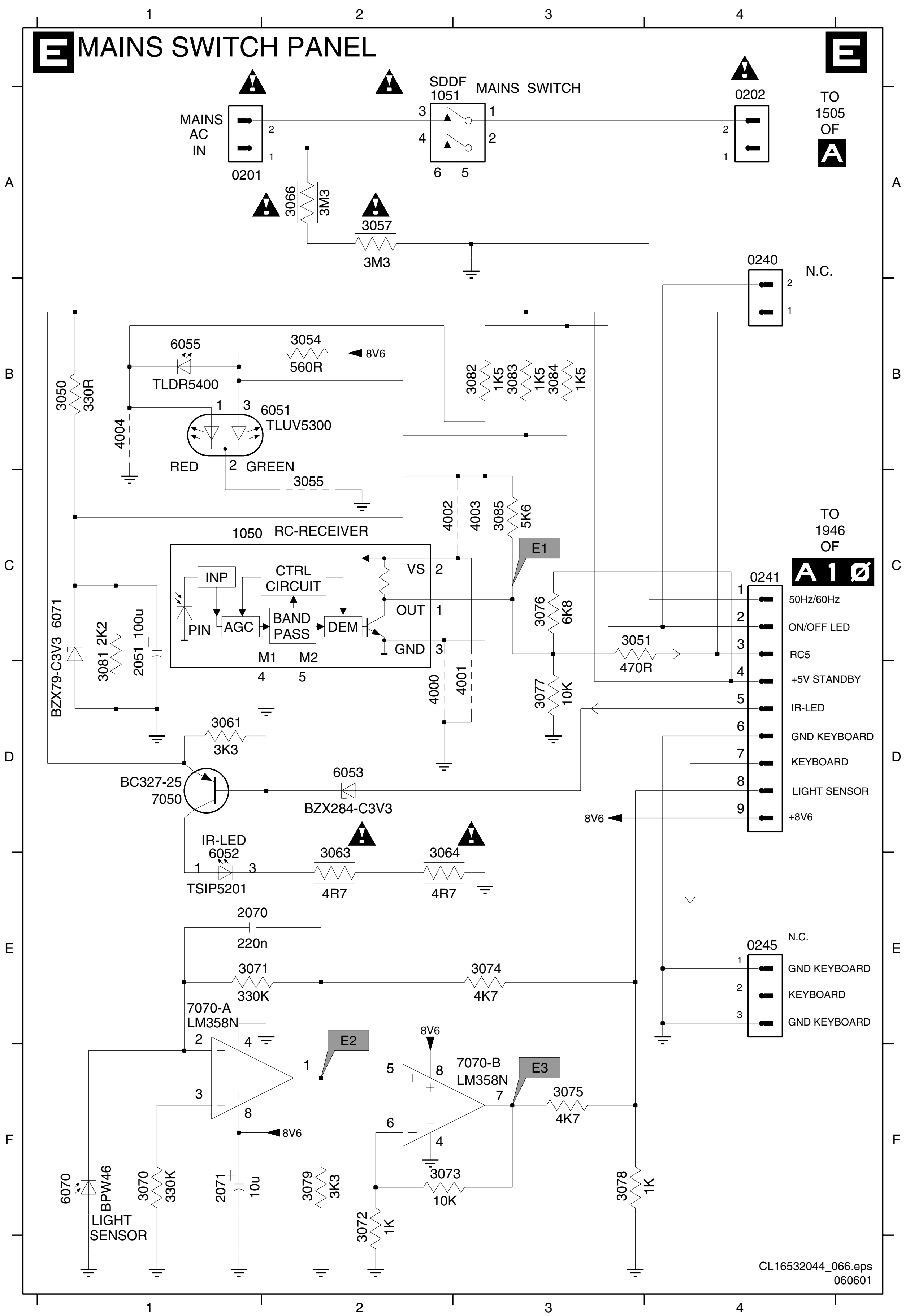


**SSB (Tuner Side Part 4)**



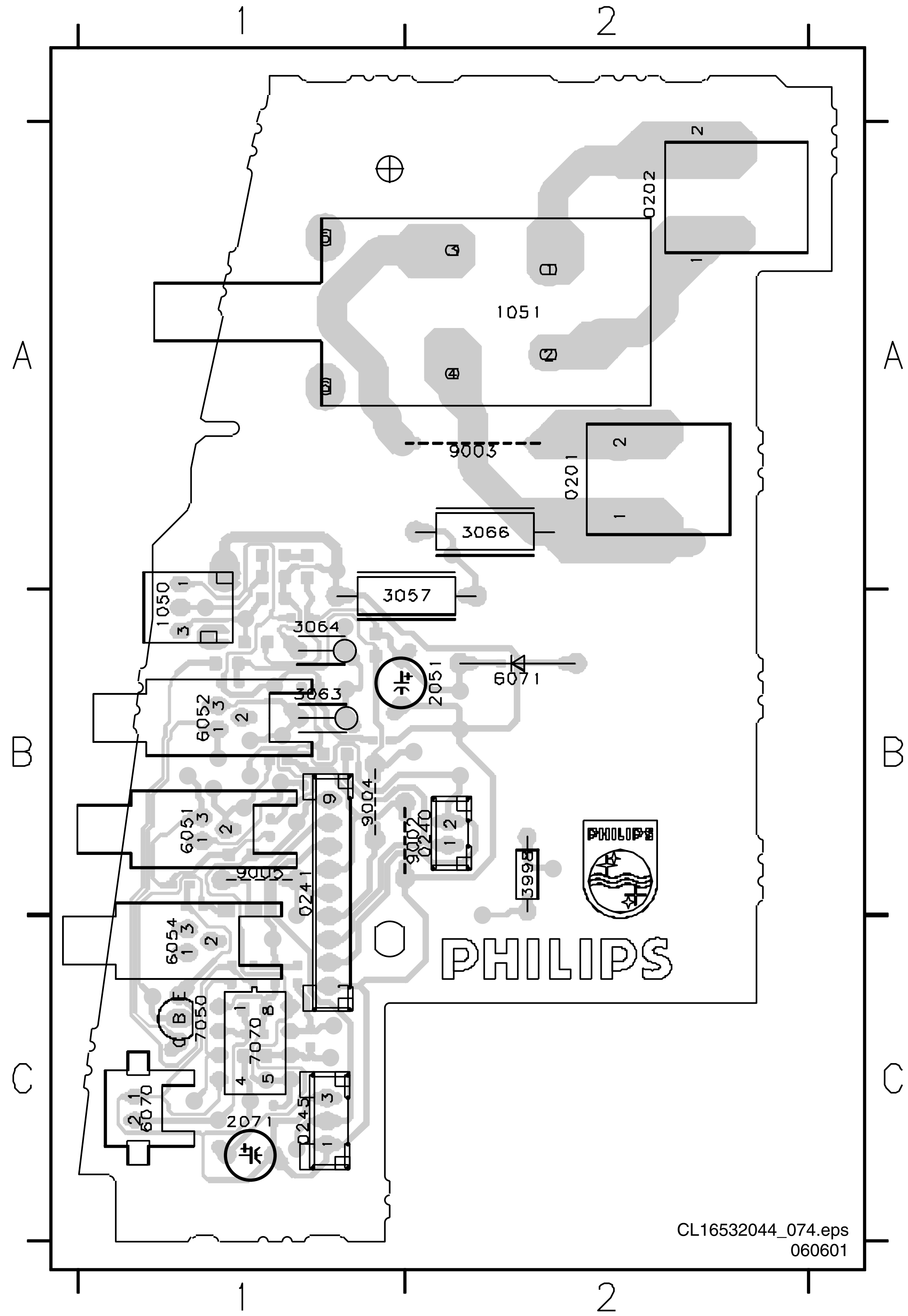
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180601

## Mains Switch Panel



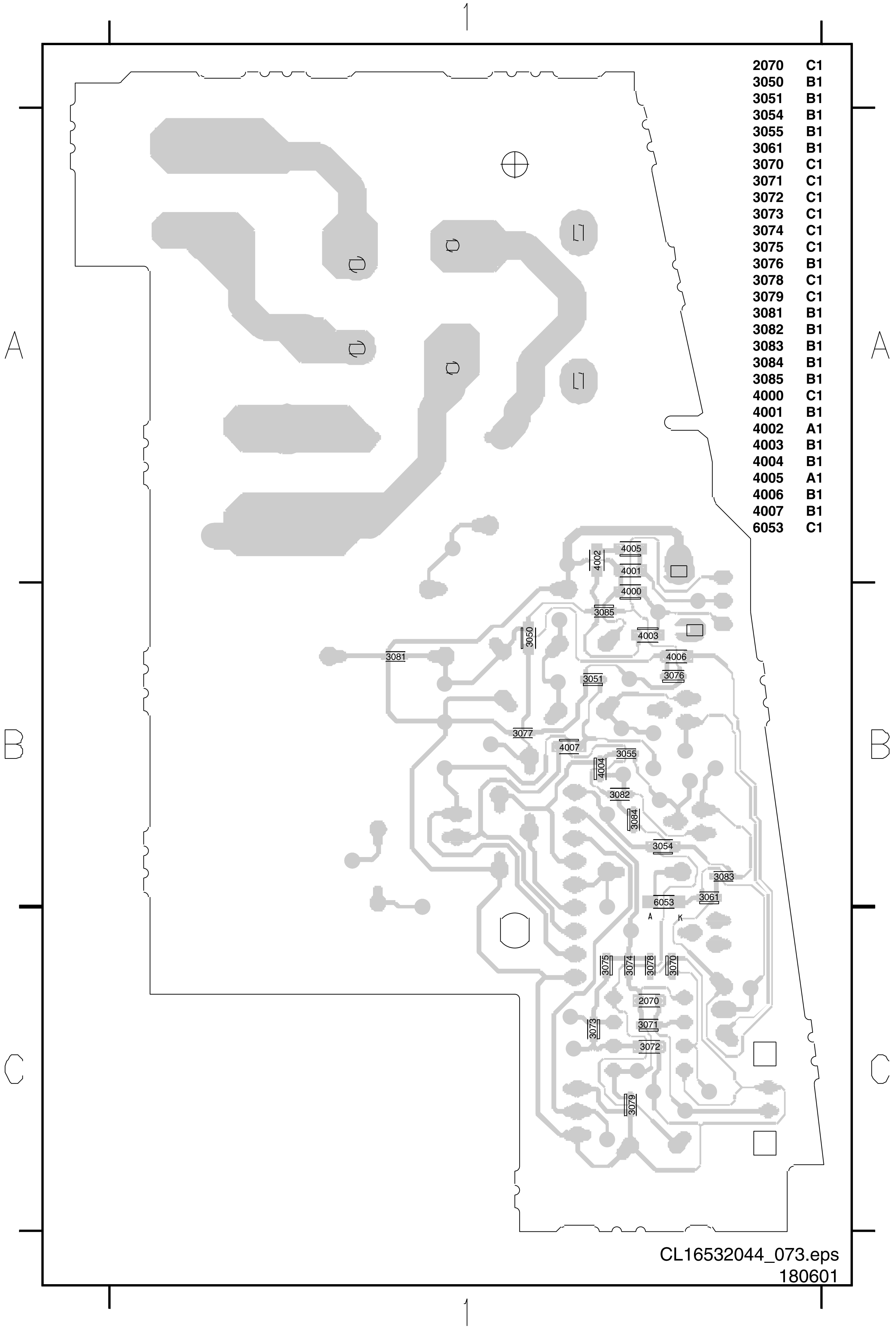

| | |
|---|---|
| 0201 | A2 |
| 0202 | A4 |
| 0240 | A4 |
| 0241 | C4 |
| 0245 | E4 |
| 1050 | C1 |
| 1051 | A2 |
| 2051 | C1 |
| 2070 | E1 |
| 2071 | F1 |
| 3050 | B1 |
| 3051 | C3 |
| 3054 | B2 |
| 3055 | C2 |
| 3057 | A2 |
| 3061 | D1 |
| 3063 | E2 |
| 3064 | E2 |
| 3066 | A2 |
| 3070 | F1 |
| 3071 | E1 |
| 3072 | F2 |
| 3073 | F2 |
| 3074 | E3 |
| 3075 | F3 |
| 3076 | C3 |
| 3077 | D3 |
| 3078 | F3 |
| 3079 | F2 |
| 3081 | D1 |
| 3082 | B3 |
| 3083 | B3 |
| 3084 | B3 |
| 3085 | C3 |
| 3998 | F4 |
| 4000 | D2 |
| 4001 | D3 |
| 4002 | C2 |
| 4003 | C3 |
| 4004 | B1 |
| 6051 | B1 |
| 6052 | E1 |
| 6053 | D2 |
| 6054 | E1 |
| 6055 | B1 |
| 6070 | F1 |
| 6071 | C1 |
| 7050 | D1 |
| 7070-A | E1 |
| 7070-B | F3 |

## Layout Mains Switch Panel (Top View)




| | |
|---|---|
| 0201 | A2 |
| 0202 | A2 |
| 0240 | B2 |
| 0241 | B1 |
| 0245 | C1 |
| 1050 | B1 |
| 1051 | A1 |
| 2051 | B2 |
| 2071 | C1 |
| 3057 | B2 |
| 3063 | B1 |
| 3064 | B1 |
| 3066 | A2 |
| 3998 | B2 |
| 6051 | B1 |
| 6052 | B1 |
| 6054 | C1 |
| 6070 | C1 |
| 6071 | B2 |
| 7050 | C1 |
| 7070 | C1 |
| 9002 | B1 |
| 9003 | A2 |
| 9004 | B1 |
| 9005 | B1 |

## Layout Mains Switch Panel (Bottom View)

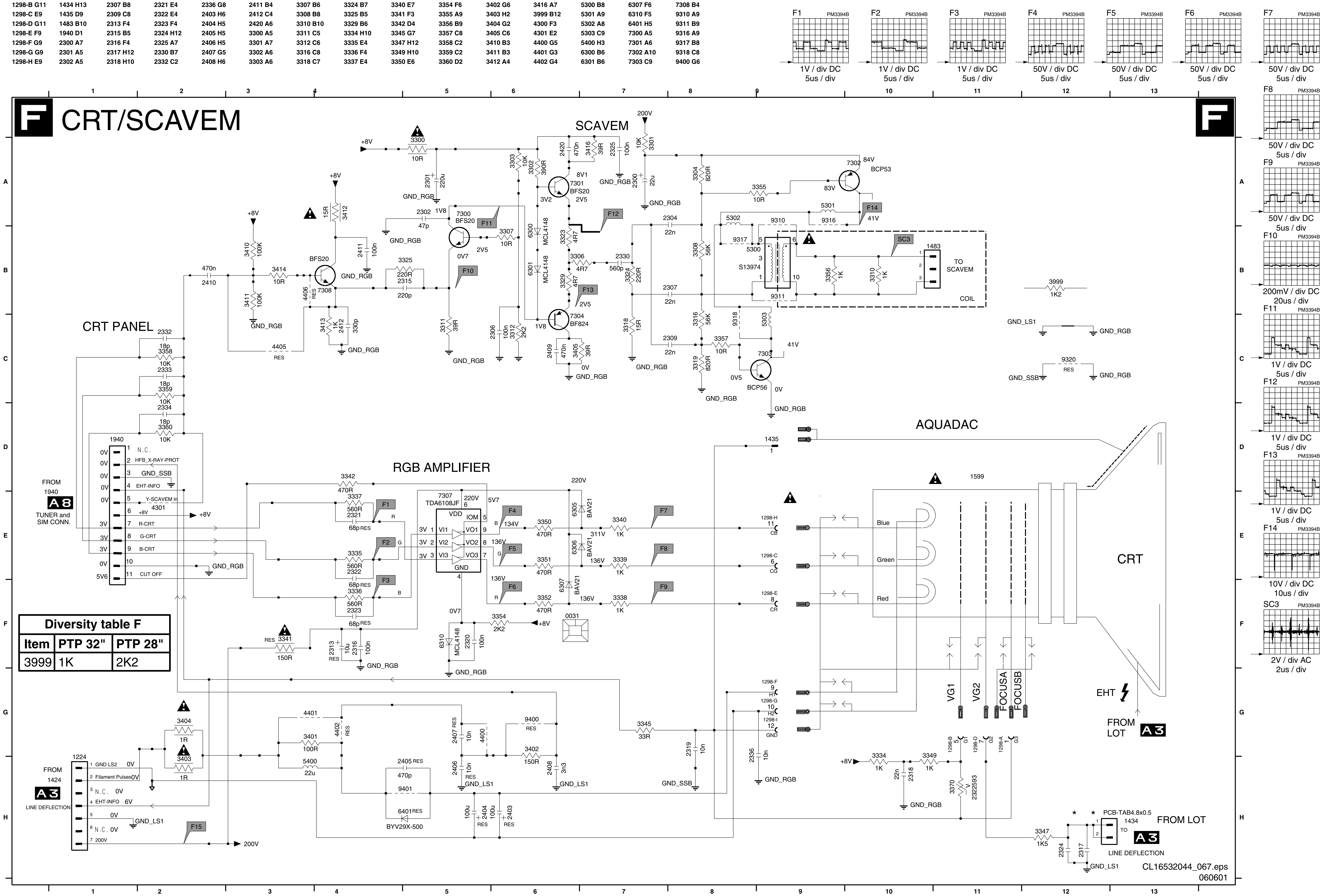



| | |
|---|---|
| 2070 | C1 |
| 3050 | B1 |
| 3051 | B1 |
| 3054 | B1 |
| 3055 | B1 |
| 3061 | B1 |
| 3070 | C1 |
| 3071 | C1 |
| 3072 | C1 |
| 3073 | C1 |
| 3074 | C1 |
| 3075 | C1 |
| 3076 | B1 |
| 3078 | C1 |
| 3079 | C1 |
| 3081 | B1 |
| 3082 | B1 |
| 3083 | B1 |
| 3084 | B1 |
| 3085 | B1 |
| 4000 | C1 |
| 4001 | B1 |
| 4002 | A1 |
| 4003 | B1 |
| 4004 | B1 |
| 4005 | A1 |
| 4006 | B1 |
| 4007 | B1 |
| 6053 | C1 |

***Personal Notes:***

## CRT / SCAVEM Panel

| 0031 F6 | 1298-I G9 | 2304 A8 | 2319 G8 | 2333 C2 | 2409 C6 | 3304 A8 | 3319 C8 | 3338 F7 | 3351 E6 | 3370 H11 | 3413 C4 | 4405 C3 | 6305 E6 | 7304 C6 | 9401 H5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1298-A G11 | 1424 H1 | 2306 C6 | 2320 F5 | 2334 D2 | 2410 B2 | 3306 B6 | 3323 B6 | 3339 E7 | 3352 F6 | 3401 G3 | 3414 B3 | 4406 B3 | 6306 E6 | 7307 E5 | |
| 1298-B G11 | 1434 H13 | 2307 B8 | 2321 E4 | 2336 G8 | 2411 B4 | 3307 B6 | 3324 B7 | 3340 E7 | 3354 F6 | 3402 G6 | 3416 A7 | 5300 B8 | 6307 F6 | 7308 B4 | |
| 1298-C E9 | 1435 D9 | 2309 C8 | 2322 E4 | 2403 H6 | 2412 C4 | 3308 B8 | 3325 B5 | 3341 F3 | 3355 A9 | 3403 H2 | 3999 B12 | 5301 A9 | 6310 F5 | 9310 A9 | |
| 1298-D G11 | 1483 B10 | 2313 F4 | 2323 F4 | 2404 H5 | 2420 A6 | 3310 B10 | 3329 B6 | 3342 D4 | 3356 B9 | 3404 G2 | 4300 F3 | 5302 A8 | 6401 H5 | 9311 B9 | |
| 1298-E F9 | 1940 D1 | 2315 B5 | 2324 H12 | 2405 H5 | 3300 A5 | 3311 C5 | 3334 H10 | 3345 G7 | 3357 C8 | 3405 C6 | 4301 E2 | 5303 C9 | 7300 A5 | 9316 A9 | |
| 1298-F G9 | 2300 A7 | 2316 F4 | 2325 A7 | 2406 H5 | 3301 A7 | 3312 C6 | 3335 E4 | 3347 H12 | 3358 C2 | 3410 B3 | 4400 G5 | 5400 H3 | 7301 A6 | 9317 B8 | |
| 1298-G G9 | 2301 A5 | 2317 H12 | 2330 B7 | 2407 G5 | 3302 A6 | 3316 C8 | 3336 F4 | 3349 H10 | 3359 C2 | 3411 B3 | 4401 G3 | 6300 B6 | 7302 A10 | 9318 C8 | |
| 1298-H E9 | 2302 A5 | 2318 H10 | 2332 C2 | 2408 H6 | 3303 A6 | 3318 C7 | 3337 E4 | 3350 E6 | 3360 D2 | 3412 A4 | 4402 G4 | 6301 B6 | 7303 C9 | 9400 G6 | |

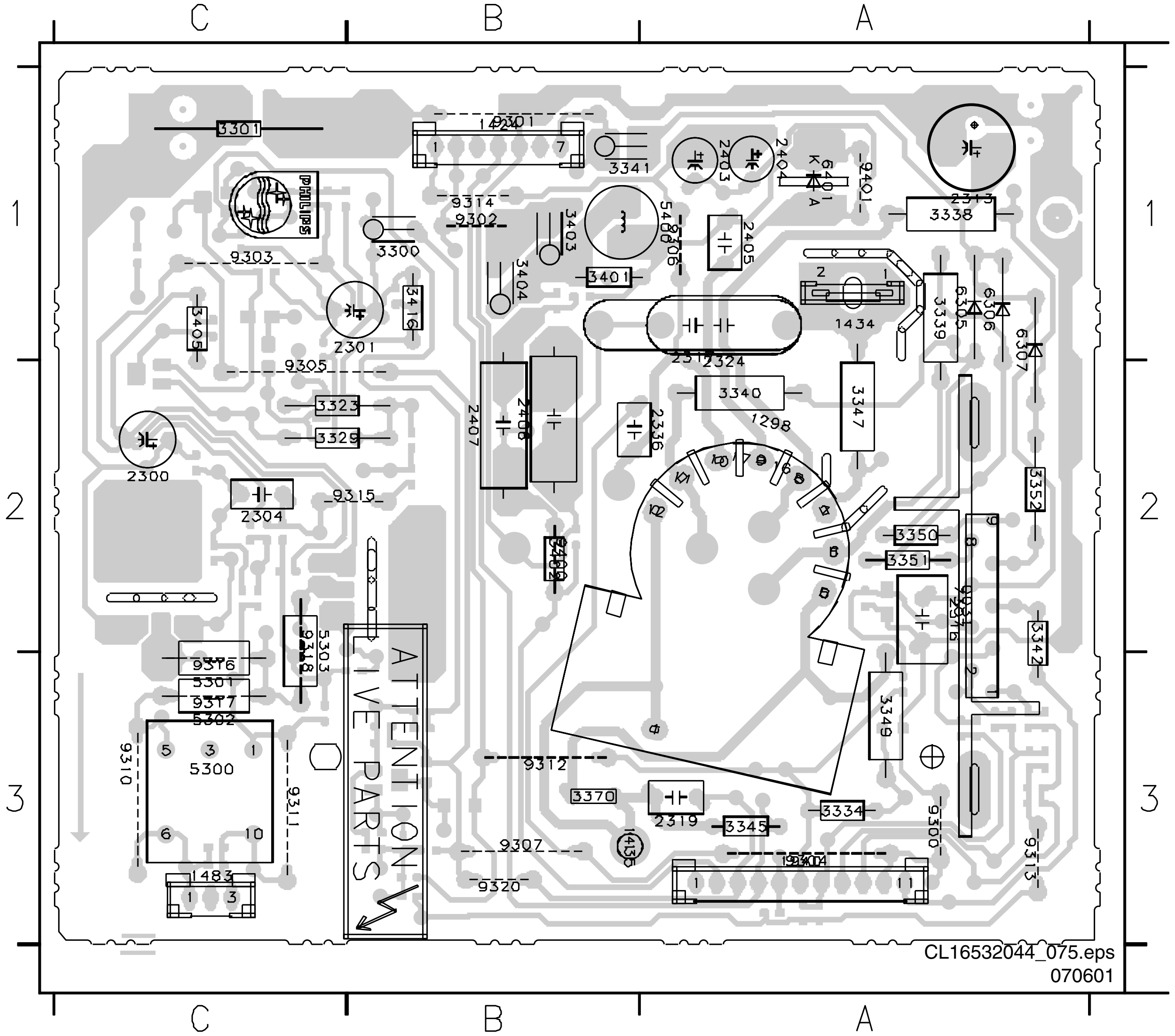



**Diversity table F**

| Item | PTP 32" | PTP 28" |
|---|---|---|
| 3999 | 1K | 2K2 |

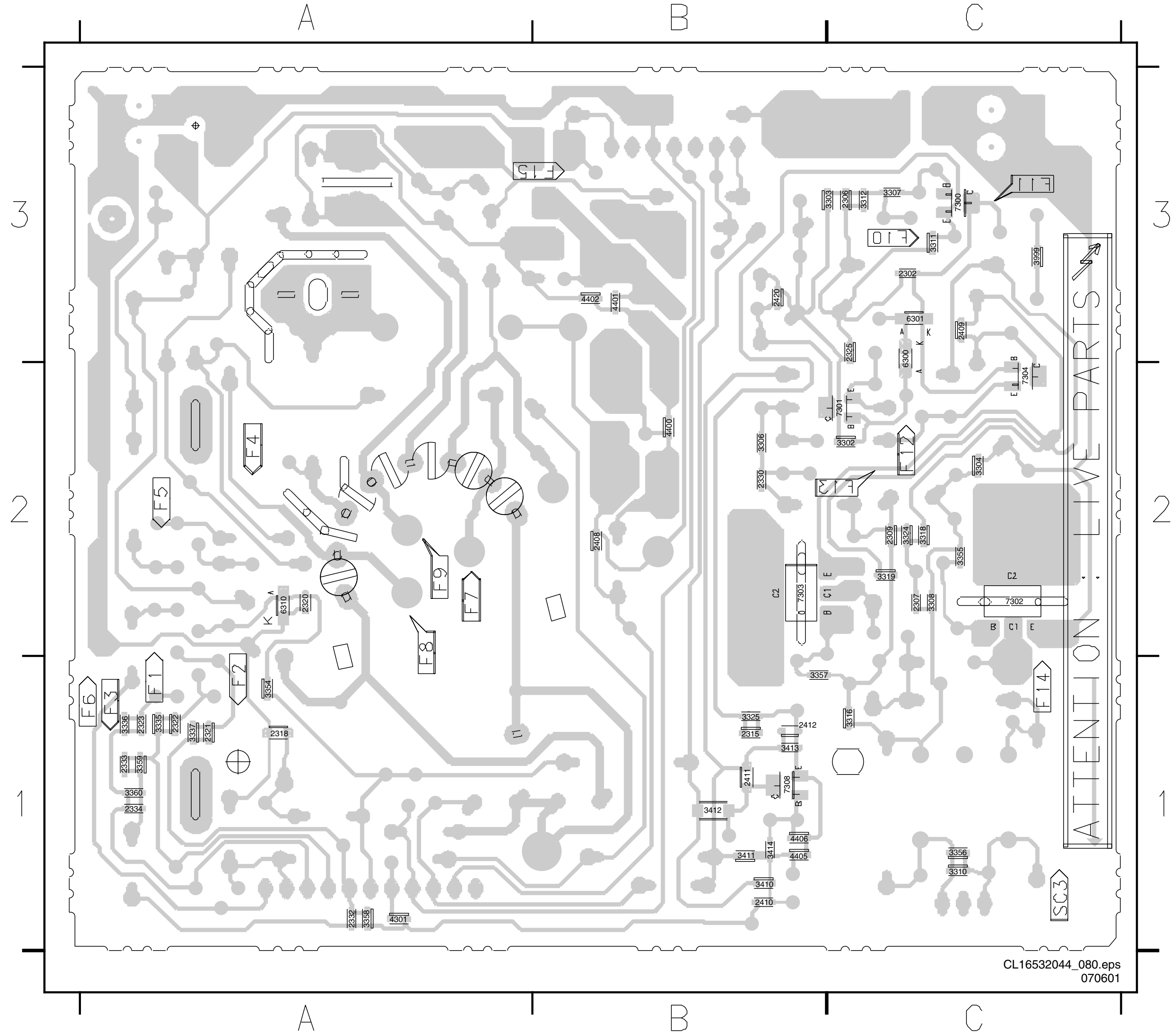
## CRT/SCAVEM Panel (Top Side)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0031 A2 | 2300 C2 | 2324 A2 | 3300 B1 | 3340 A2 | 3351 A2 | 3405 C1 | 6305 A1 | 9302 B1 | 9311 C3 | 9318 C2 |
| 1298 A3 | 2301 B1 | 2336 A2 | 3301 C1 | 3341 A1 | 3352 A2 | 3416 B1 | 6306 A1 | 9303 C1 | 9312 B3 | 9320 B3 |
| 1424 B1 | 2304 C2 | 2403 A1 | 3323 C2 | 3342 A2 | 3370 B3 | 5300 C3 | 6307 A1 | 9304 A3 | 9313 A3 | 9400 B2 |
| 1434 A1 | 2313 A1 | 2404 A1 | 3329 C2 | 3345 A3 | 3401 B1 | 5301 C2 | 6401 A1 | 9305 C2 | 9314 B1 | 9401 A1 |
| 1435 A3 | 2316 A2 | 2405 A1 | 3334 A3 | 3347 A2 | 3402 B2 | 5302 C3 | 7307 A2 | 9306 A1 | 9315 B2 | |
| 1483 C3 | 2317 B2 | 2406 B2 | 3338 A1 | 3349 A3 | 3403 B1 | 5303 C2 | 9300 A3 | 9307 B3 | 9316 C2 | |
| 1940 A3 | 2319 A3 | 2407 B2 | 3339 A2 | 3350 A2 | 3404 B1 | 5400 A1 | 9301 B1 | 9310 C3 | 9317 C3 | |

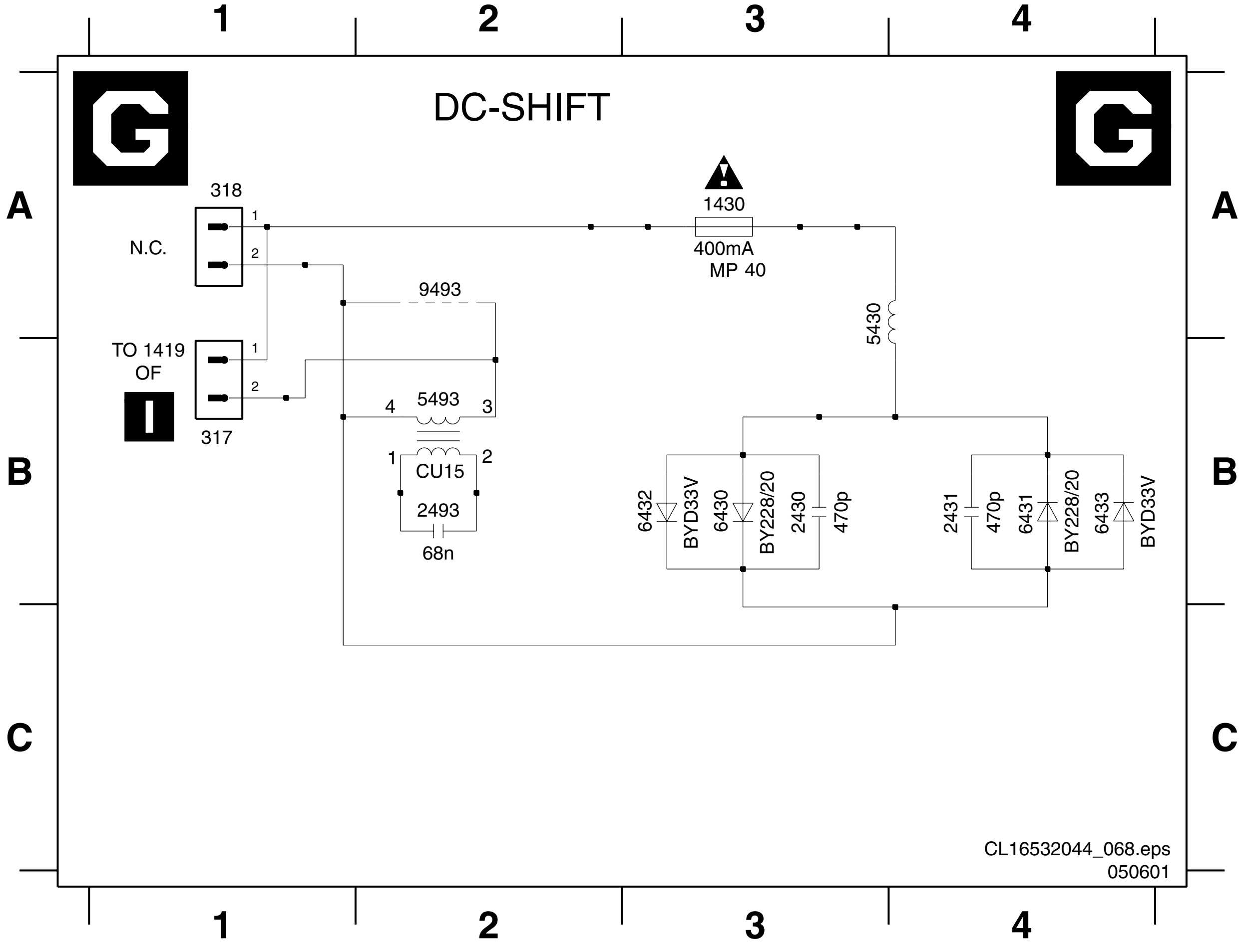



## CRT/SCAVEM Panel (Bottom Side)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2302 C3 | 2318 A1 | 2325 C3 | 2408 B2 | 2420 B3 | 2420 B3 | 3307 C3 | 3316 C1 | 3335 A1 | 3356 C1 | 3410 B1 | 3416 B3 | 4402 B3 | 6310 A2 | 7304 C2 | |
| 2306 C3 | 2320 A2 | 2330 B2 | 2409 C3 | 3302 C2 | 3302 C2 | 3308 C2 | 3318 C2 | 3336 A1 | 3357 B1 | 3411 B1 | 3999 C3 | 4405 B1 | 7300 C3 | 7308 B1 |
| 2307 C2 | 2321 A1 | 2332 A1 | 2410 B1 | 3303 C3 | 3303 C3 | 3310 C1 | 3319 C2 | 3337 A1 | 3358 A1 | 3412 B1 | 4301 A1 | 4406 B1 | 7301 C2 | |
| 2309 C2 | 2322 A1 | 2333 A1 | 2411 B1 | 3304 C2 | 3304 C2 | 3311 C3 | 3324 C2 | 3354 A1 | 3359 A1 | 3413 B1 | 4400 B2 | 6300 C3 | 7302 C2 | |
| 2315 B1 | 2323 A1 | 2334 A1 | 2412 B1 | 3306 B2 | 3306 B2 | 3312 C3 | 3325 B1 | 3355 C2 | 3360 A1 | 3414 B1 | 4401 B3 | 6301 C3 | 7303 B2 | |



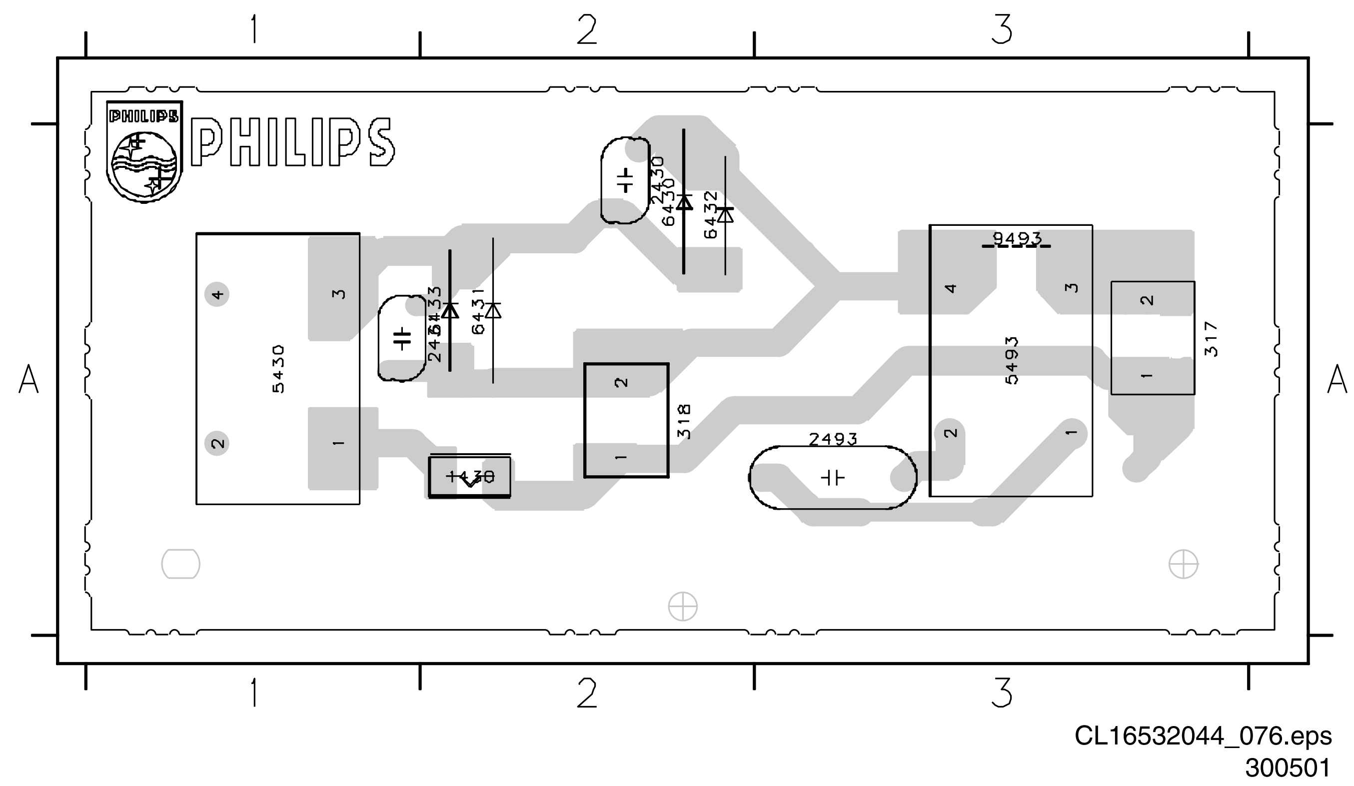
## DC-Shift




317 B1
318 A1
1430 A3
2430 B3
2431 B4
2493 B2
5430 A3
5493 B2
6430 B3
6431 B4
6432 B3
6433 B4

## Layout DC-Shift Panel (Top Side)

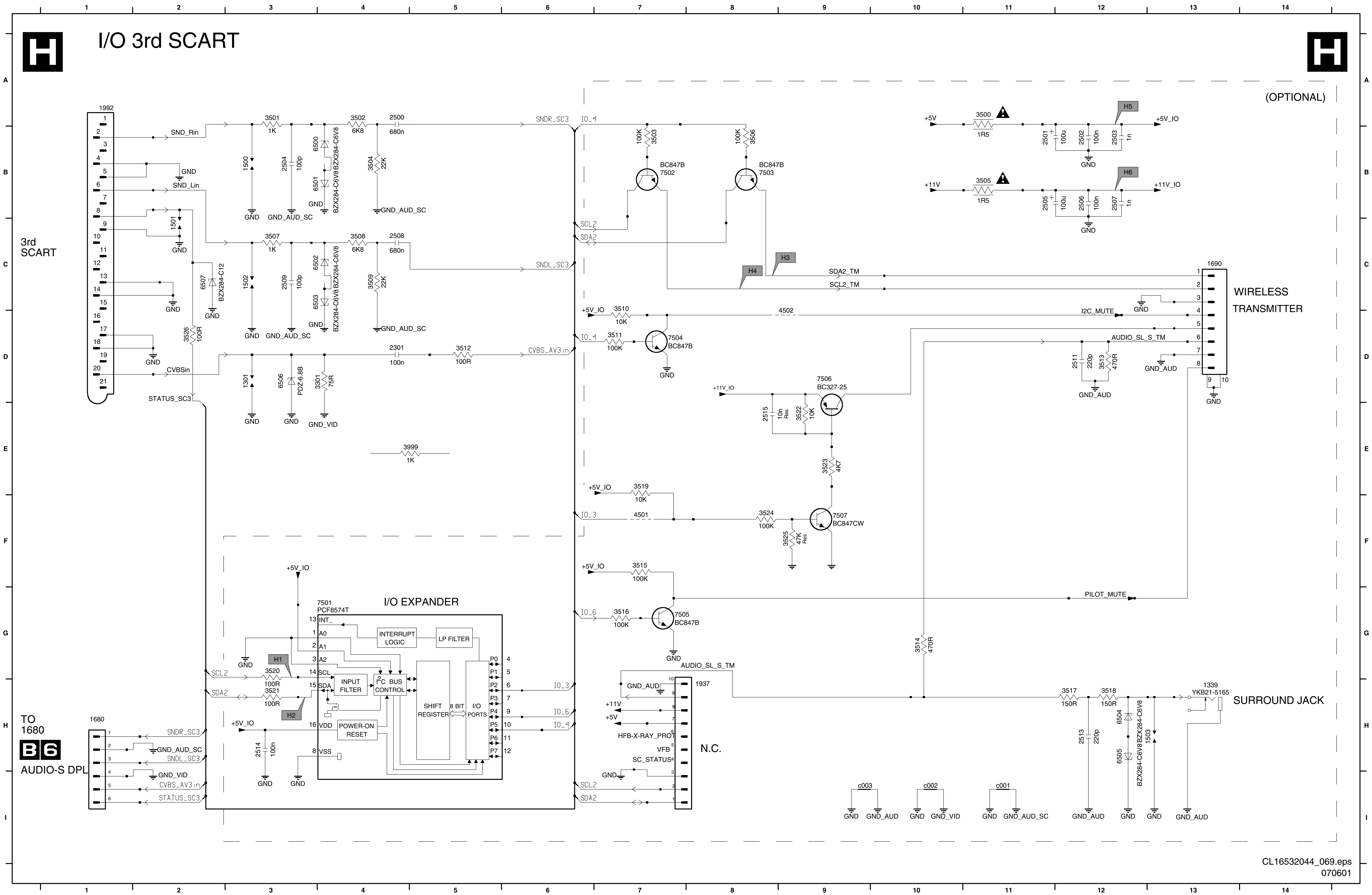
| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 317 | A3 | 1430 | A2 | 2431 | A1 | 5430 | A1 | 6430 | A2 | 6432 | A2 | 9493 | A3 |
| 318 | A2 | 2430 | A2 | 2493 | A3 | 5493 | A3 | 6431 | A2 | 6433 | A2 | | |



***Personal Notes:***

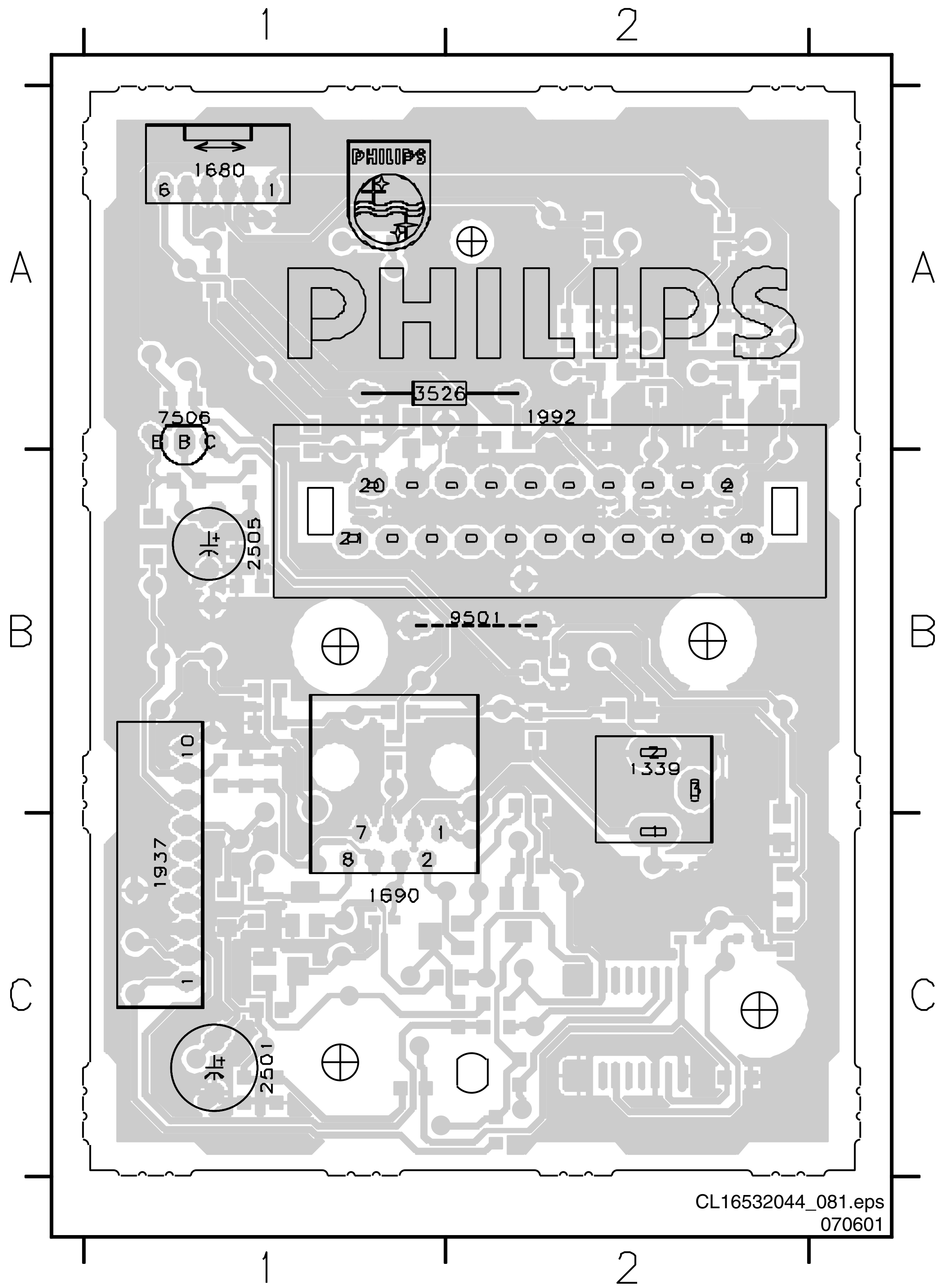
***Personal Notes:***

## I/O 3rd SCART Panel



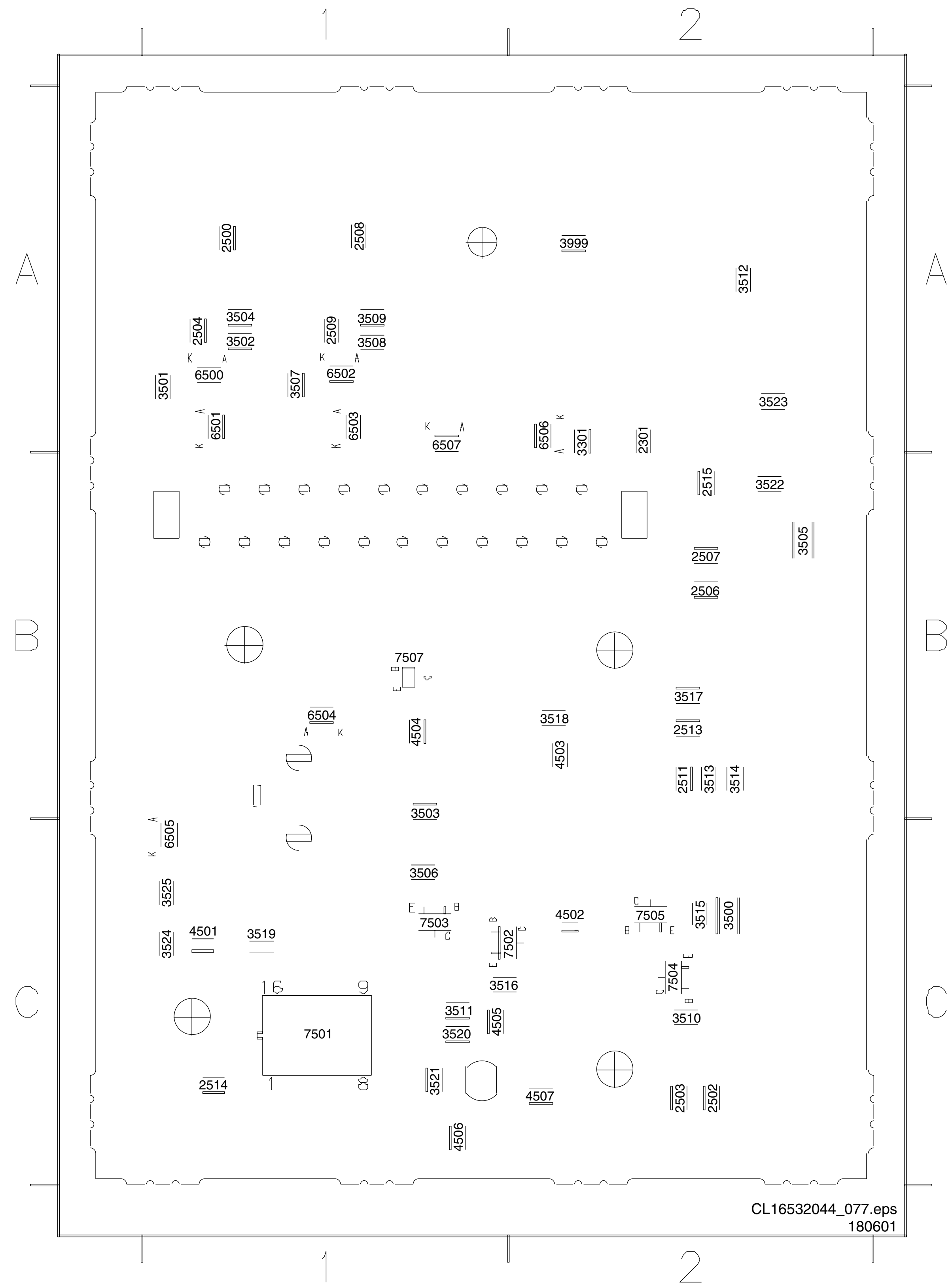

1301 D3
1339 H13
1500 B3
1501 C2
1502 C3
1503 H13
1680 H1
1690 C13
1937 H8
1992 A1
2301 D4
2500 A4
2501 B11
2502 B12
2503 B12
2504 B3
2505 B11
2506 B12
2507 B12
2508 C4
2509 C3
2511 D12
2513 H12
2514 H3
2515 E8
3301 D4
3500 A11
3501 A3
3502 A4
3503 B7
3504 B4
3505 B11
3506 B8
3507 C3
3508 C4
3509 C4
3510 D7
3511 D7
3512 D5
3513 D12
3514 G10
3515 F7
3516 G7
3517 H12
3518 H12
3519 E7
3520 G3
3521 H3
3522 E9
3523 E9
3524 F8
3525 F9
3526 D2
3999 E5
4501 F7
4502 D9
6500 B4
6501 B4
6502 C4
6503 C4
6504 H12
6505 H12
6506 D3
6507 C2
7501 G4
7502 B7
7503 B8
7504 D7
7505 G7
7506 D9
7507 F9
c001 I11
c002 I10
c003 I9

## Layout I/O 3rd SCART Panel (Top Side)



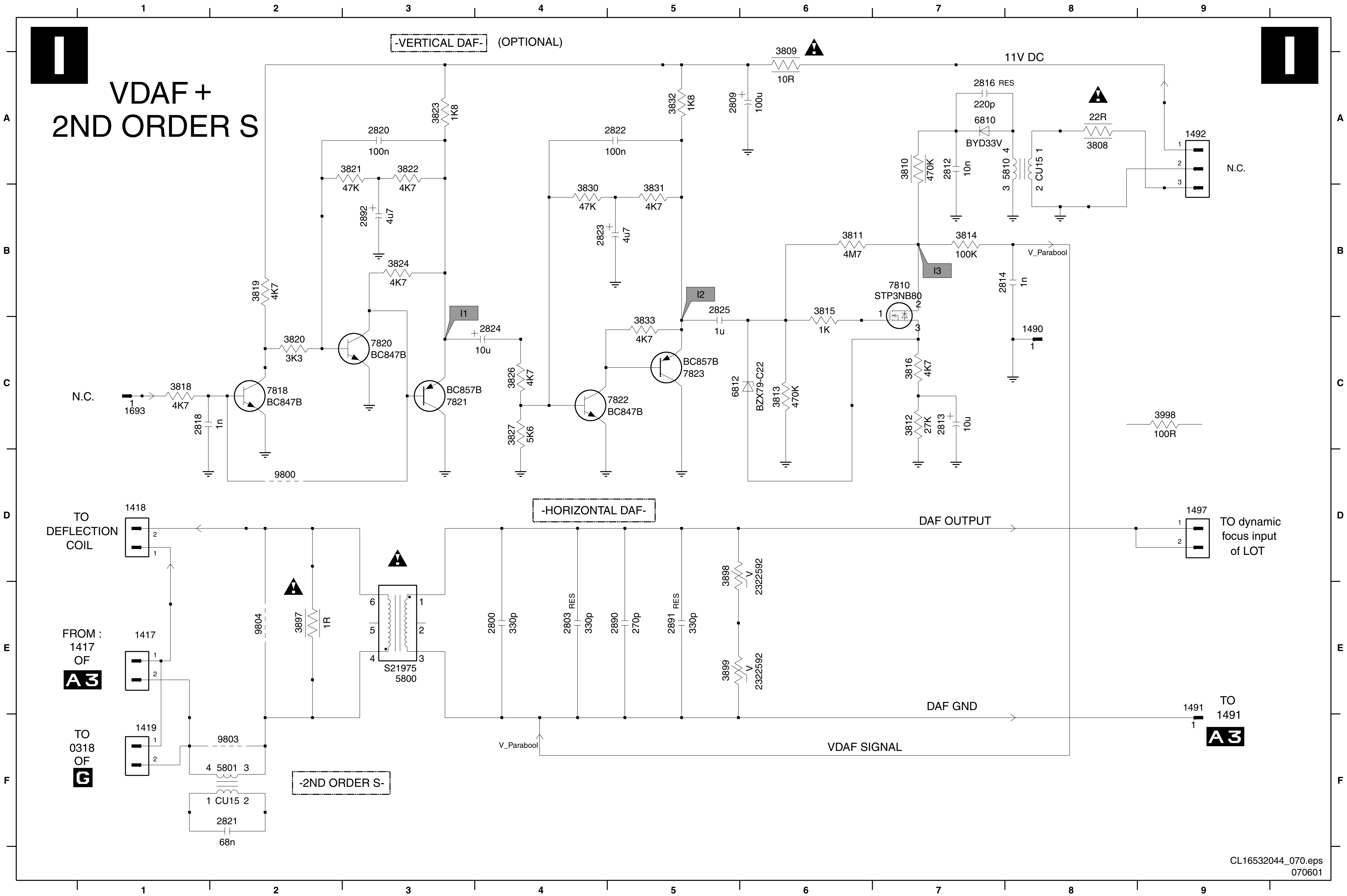
| | |
|---|---|
| 1339 | B2 |
| 1680 | A1 |
| 1690 | C1 |
| 1937 | C1 |
| 1992 | A2 |
| 2501 | C1 |
| 2505 | B1 |
| 3526 | A1 |
| 7506 | A1 |
| 9501 | B2 |

## Layout I/O 3rd SCART Panel (Bottom Side)



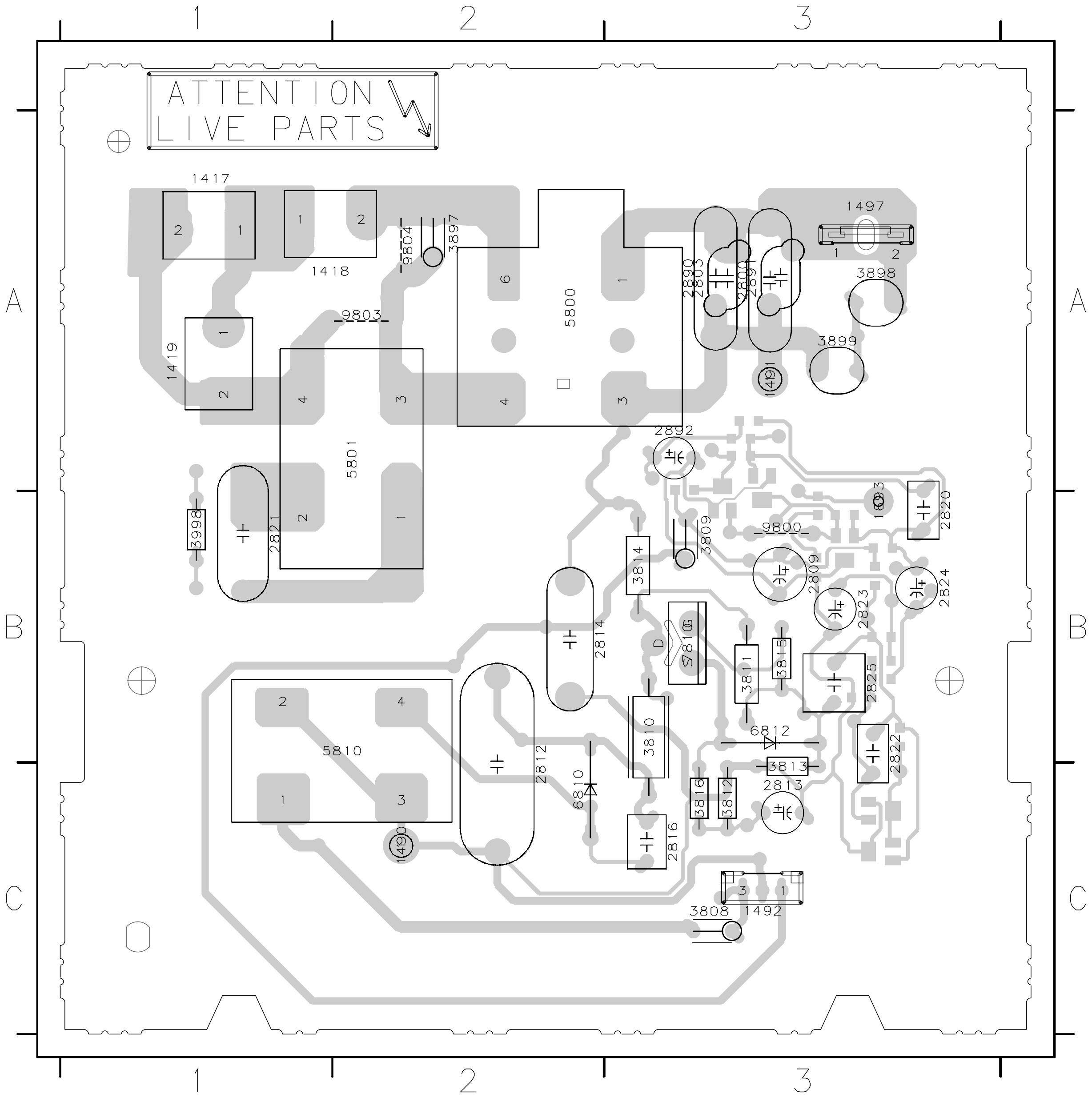
| | |
|---|---|
| 2301 | A2 |
| 2500 | A1 |
| 2502 | C2 |
| 2503 | C2 |
| 2504 | A1 |
| 2506 | B2 |
| 2507 | B2 |
| 2508 | A1 |
| 2509 | A1 |
| 2511 | B2 |
| 2513 | B2 |
| 2514 | C1 |
| 2515 | B2 |
| 3301 | A2 |
| 3500 | C2 |
| 3501 | A1 |
| 3502 | A1 |
| 3503 | B1 |
| 3504 | A1 |
| 3505 | B2 |
| 3506 | C1 |
| 3507 | A1 |
| 3508 | A1 |
| 3509 | A1 |
| 3510 | C2 |
| 3511 | C1 |
| 3512 | A2 |
| 3513 | B2 |
| 3514 | B2 |
| 3515 | C2 |
| 3516 | C1 |
| 3517 | B2 |
| 3518 | B2 |
| 3519 | C1 |
| 3520 | C1 |
| 3521 | C1 |
| 3522 | B2 |
| 3523 | A2 |
| 3524 | C1 |
| 3525 | C1 |
| 3999 | A2 |
| 4501 | C1 |
| 4502 | C2 |
| 4503 | B2 |
| 4504 | B1 |
| 4505 | C1 |
| 4506 | C1 |
| 4507 | C2 |
| 6500 | A1 |
| 6501 | A1 |
| 6502 | A1 |
| 6503 | A1 |
| 6504 | B1 |
| 6505 | C1 |
| 6506 | A2 |
| 6507 | A1 |
| 7501 | C1 |
| 7502 | C2 |
| 7503 | C1 |
| 7504 | C2 |
| 7505 | C2 |
| 7507 | B1 |

## VDAF + 2nd Order S Panel




| | |
|---|---|
| 1417 E1 | 7823 C5 |
| 1418 D1 | 9800 D2 |
| 1419 F1 | 9803 F2 |
| 1490 C8 | 9804 E2 |
| 1491 E9 | |
| 1492 A9 | |
| 1497 D9 | |
| 1693 C1 | |
| 2800 E4 | |
| 2803 E4 | |
| 2809 A5 | |
| 2812 A7 | |
| 2813 C7 | |
| 2814 B8 | |
| 2816 A7 | |
| 2818 C1 | |
| 2820 A3 | |
| 2821 F2 | |
| 2822 A5 | |
| 2823 B4 | |
| 2824 C4 | |
| 2825 B5 | |
| 2890 E5 | |
| 2891 E5 | |
| 2892 B3 | |
| 3808 A8 | |
| 3809 A6 | |
| 3810 A7 | |
| 3811 B6 | |
| 3812 C7 | |
| 3813 C6 | |
| 3814 B7 | |
| 3815 B6 | |
| 3816 C7 | |
| 3818 C1 | |
| 3819 B2 | |
| 3820 C2 | |
| 3821 A3 | |
| 3822 A3 | |
| 3823 A3 | |
| 3824 B3 | |
| 3826 C4 | |
| 3827 C4 | |
| 3830 B4 | |
| 3831 B5 | |
| 3832 A5 | |
| 3833 C5 | |
| 3897 E2 | |
| 3898 D5 | |
| 3899 E5 | |
| 3998 C9 | |
| 5800 E3 | |
| 5801 F2 | |
| 5810 A8 | |
| 6810 A7 | |
| 6812 C5 | |
| 7810 B7 | |
| 7818 C2 | |
| 7820 C3 | |
| 7821 C3 | |
| 7822 C5 | |

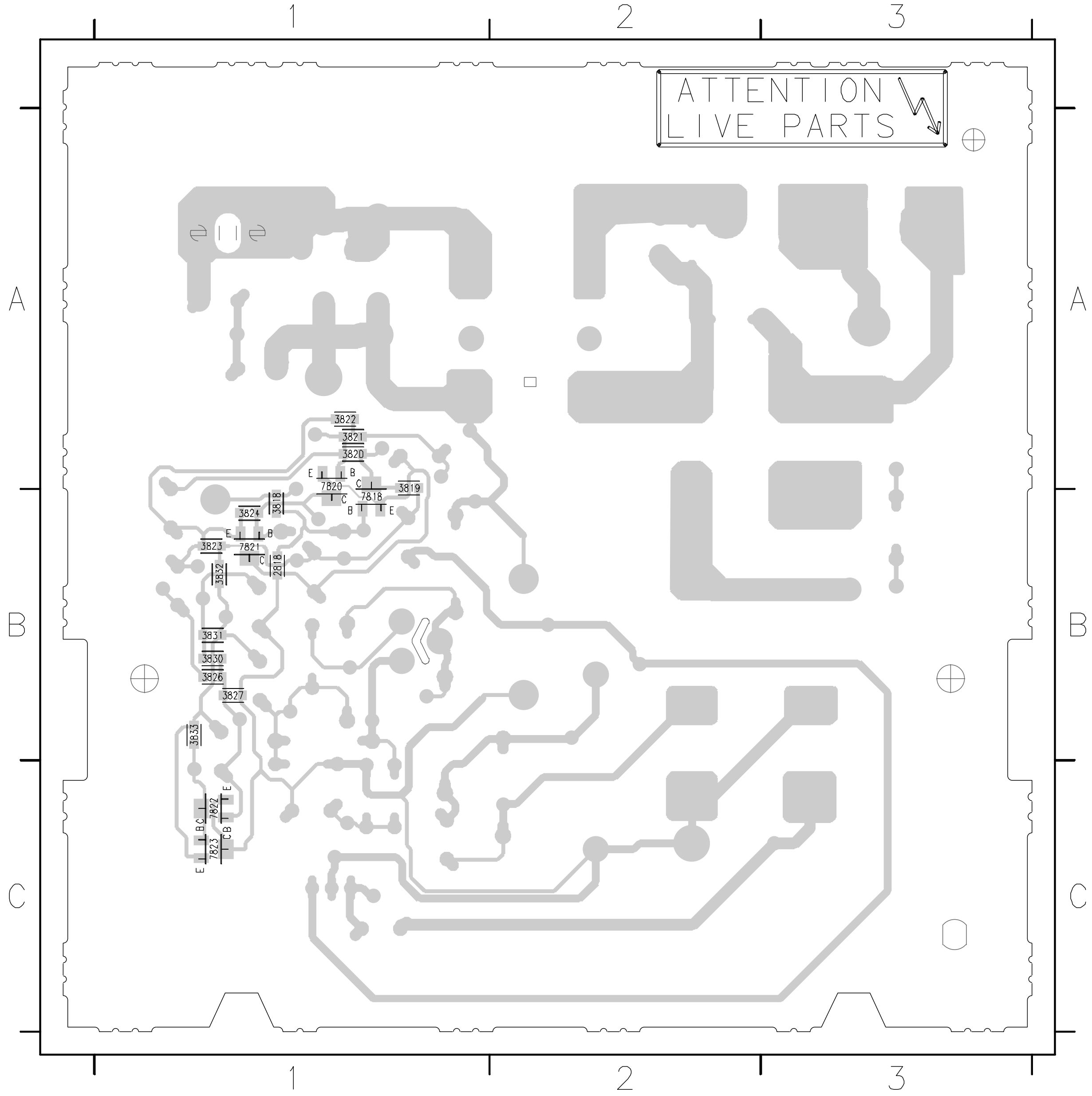
## Layout VDAF + 2nd Order S Panel (Top Side)




| | |
|---|---|
| 1417 | A1 |
| 1418 | A1 |
| 1419 | A1 |
| 1490 | C2 |
| 1491 | A3 |
| 1492 | C3 |
| 1497 | A3 |
| 1693 | B3 |
| 2800 | A3 |
| 2803 | A3 |
| 2809 | B3 |
| 2812 | C2 |
| 2813 | C3 |
| 2814 | B2 |
| 2816 | C3 |
| 2820 | B3 |
| 2821 | B1 |
| 2822 | B3 |
| 2823 | B3 |
| 2824 | B3 |
| 2825 | B3 |
| 2890 | A3 |
| 2891 | A3 |
| 2892 | A3 |
| 3808 | C3 |
| 3809 | B3 |
| 3810 | B3 |
| 3811 | B3 |
| 3812 | C3 |
| 3813 | C3 |
| 3814 | B3 |
| 3815 | B3 |
| 3816 | C3 |
| 3897 | A2 |
| 3898 | A3 |
| 3899 | A3 |
| 3998 | B1 |
| 5800 | A2 |
| 5801 | A1 |
| 5810 | B2 |
| 6810 | C2 |
| 6812 | B3 |
| 7810 | B3 |
| 9800 | B3 |
| 9803 | A2 |
| 9804 | A2 |

CL16532044_086.eps
060601

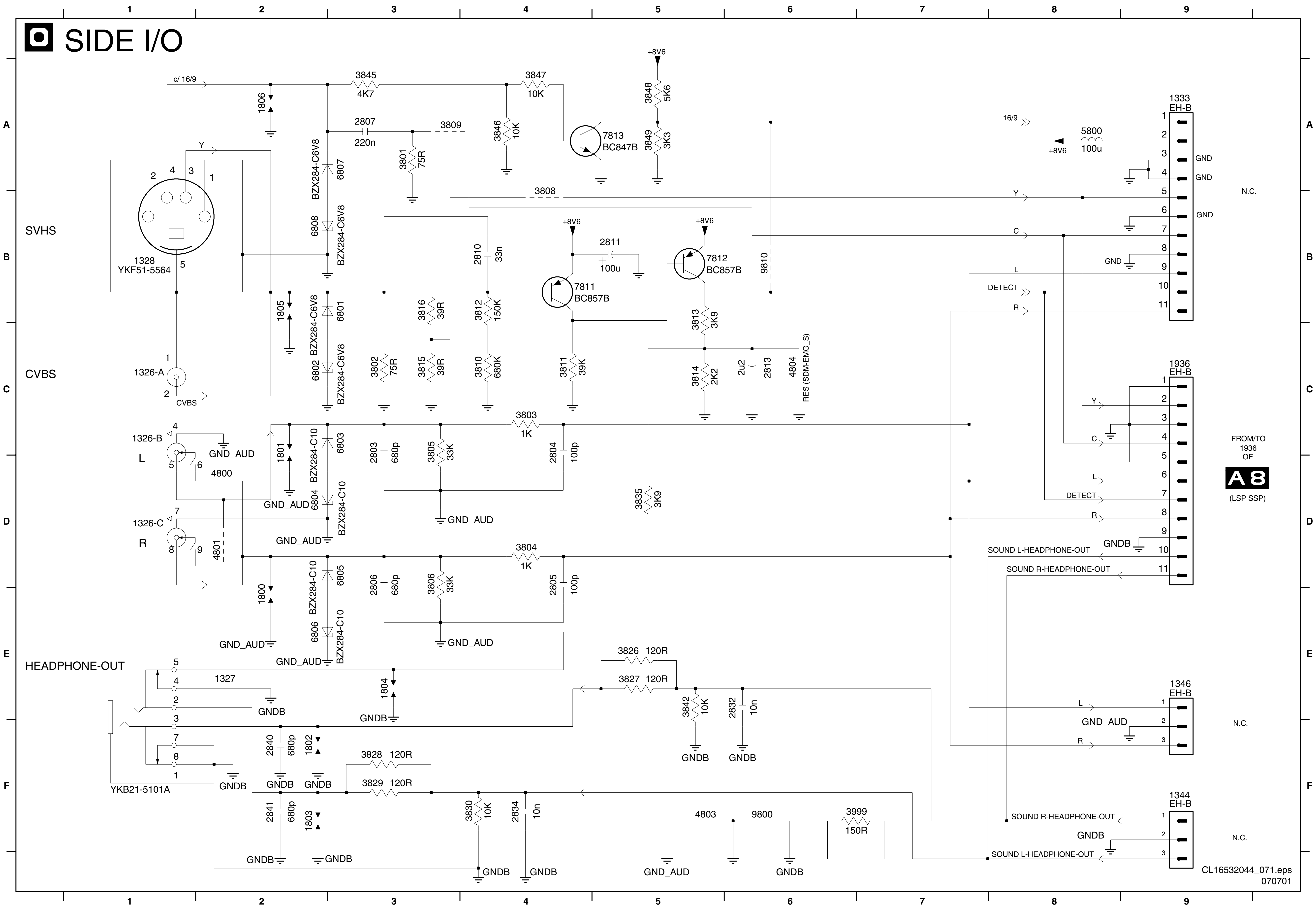
## Layout VDAF + 2nd Order S Panel (Bottom Side)




| | |
|---|---|
| 2818 | B1 |
| 3818 | B1 |
| 3819 | A1 |
| 3820 | A1 |
| 3821 | A1 |
| 3822 | A1 |
| 3823 | B1 |
| 3824 | B1 |
| 3826 | B1 |
| 3827 | B1 |
| 3830 | B1 |
| 3831 | B1 |
| 3832 | B1 |
| 3833 | B1 |
| 7818 | B1 |
| 7820 | B1 |
| 7821 | B1 |
| 7822 | C1 |
| 7823 | C1 |

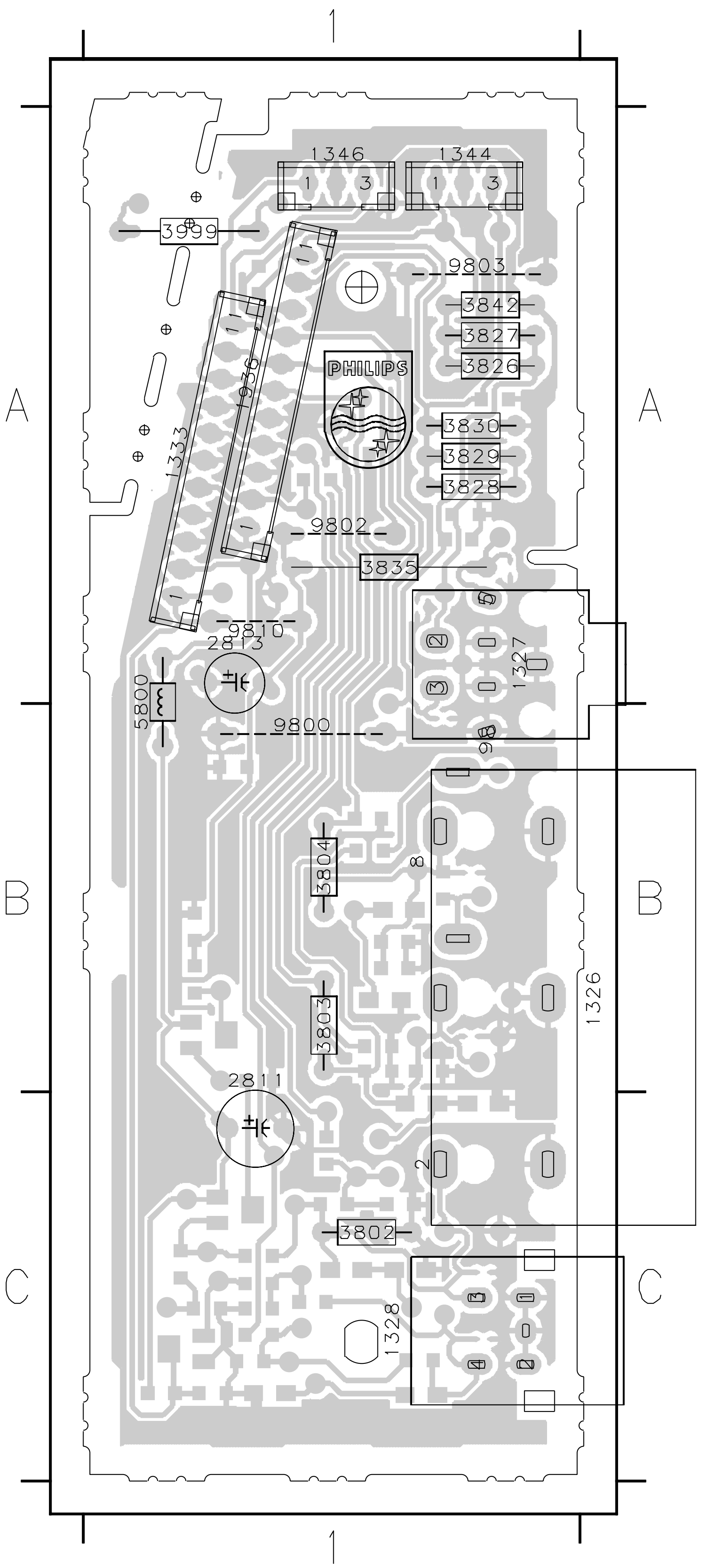
CL16532044_087.eps
180601

## Side I/O Panel




- 1326-A C1
- 1326-B C1
- 1326-C D1
- 1327 E2
- 1328 B1
- 1333 A9
- 1344 F9
- 1346 E9
- 1800 E2
- 1801 C2
- 1802 F2
- 1803 F2
- 1804 E3
- 1805 B2
- 1806 A2
- 1936 C9
- 2803 C3
- 2804 C4
- 2805 D4
- 2806 D3
- 2807 A3
- 2810 B4
- 2811 B5
- 2813 C6
- 2832 E6
- 2834 F4
- 2840 F2
- 2841 F2
- 3801 A3
- 3802 C3
- 3803 C4
- 3804 D4
- 3805 C3
- 3806 D3
- 3808 B4
- 3809 A3
- 3810 C4
- 3811 C4
- 3812 B4
- 3813 B5
- 3814 C5
- 3815 C3
- 3816 B3
- 3826 E5
- 3827 E5
- 3828 F3
- 3829 F3
- 3830 F4
- 3835 D5
- 3842 E5
- 3845 A3
- 3846 A4
- 3847 A4
- 3848 A5
- 3849 A5
- 3999 F7
- 4800 D2
- 4801 D2
- 4803 F5
- 4804 C6
- 5800 A8
- 6801 B3
- 6802 C2
- 6803 C3
- 6804 D2
- 6805 D3
- 6806 E2
- 6807 A3
- 6808 B2
- 7811 B4
- 7812 B5
- 7813 A5
- 9800 F6
- 9810 B6

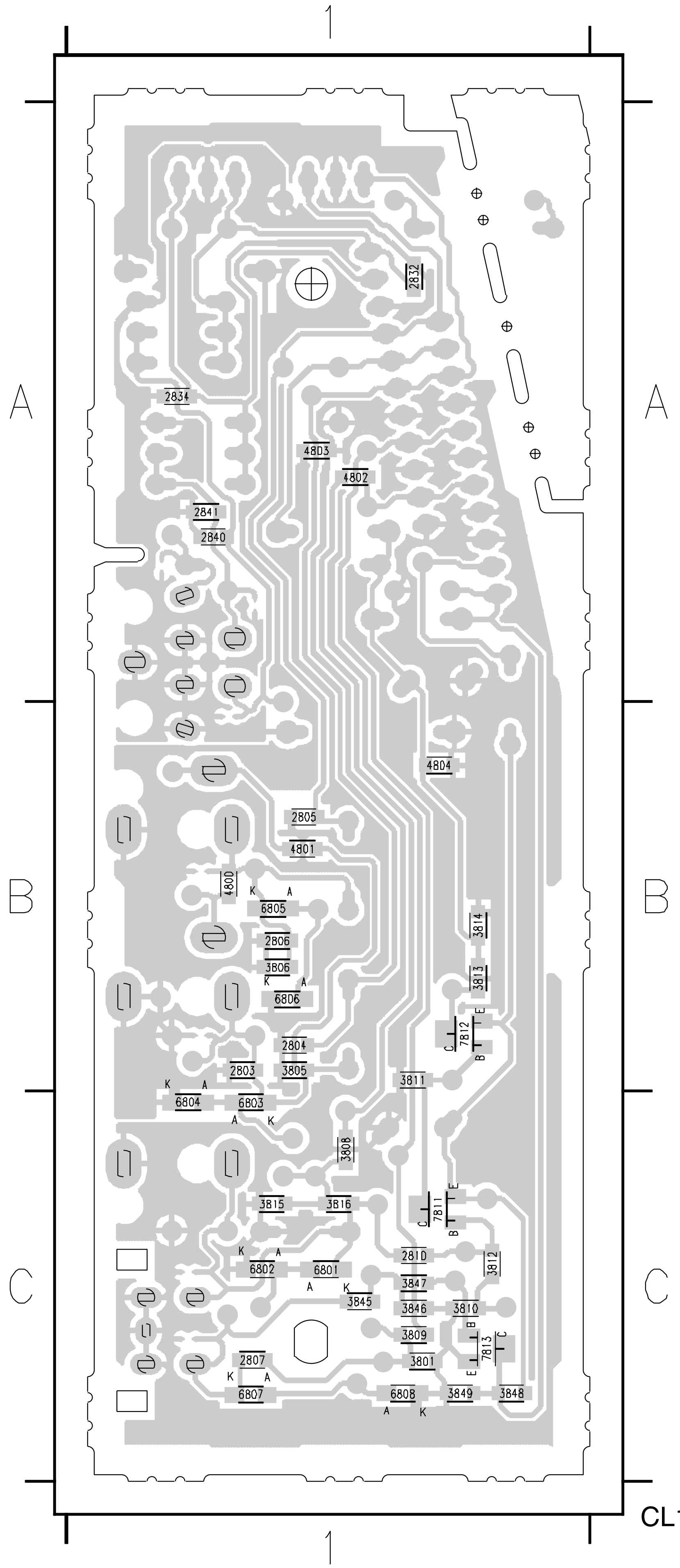
## Layout Side I/O Panel (Top Side)



CL16532044_088.eps
060601

| | |
|---|---|
| 1326 | B1 |
| 1327 | A1 |
| 1328 | C1 |
| 1333 | A1 |
| 1344 | A1 |
| 1346 | A1 |
| 1936 | A1 |
| 2811 | B1 |
| 2813 | A1 |
| 3802 | C1 |
| 3803 | B1 |
| 3804 | B1 |
| 3826 | A1 |
| 3827 | A1 |
| 3828 | A1 |
| 3829 | A1 |
| 3830 | A1 |
| 3835 | A1 |
| 3842 | A1 |
| 3999 | A1 |
| 5800 | A1 |
| 9800 | B1 |
| 9802 | A1 |
| 9803 | A1 |
| 9810 | A1 |

## Layout Side I/O Panel (Bottom Side)

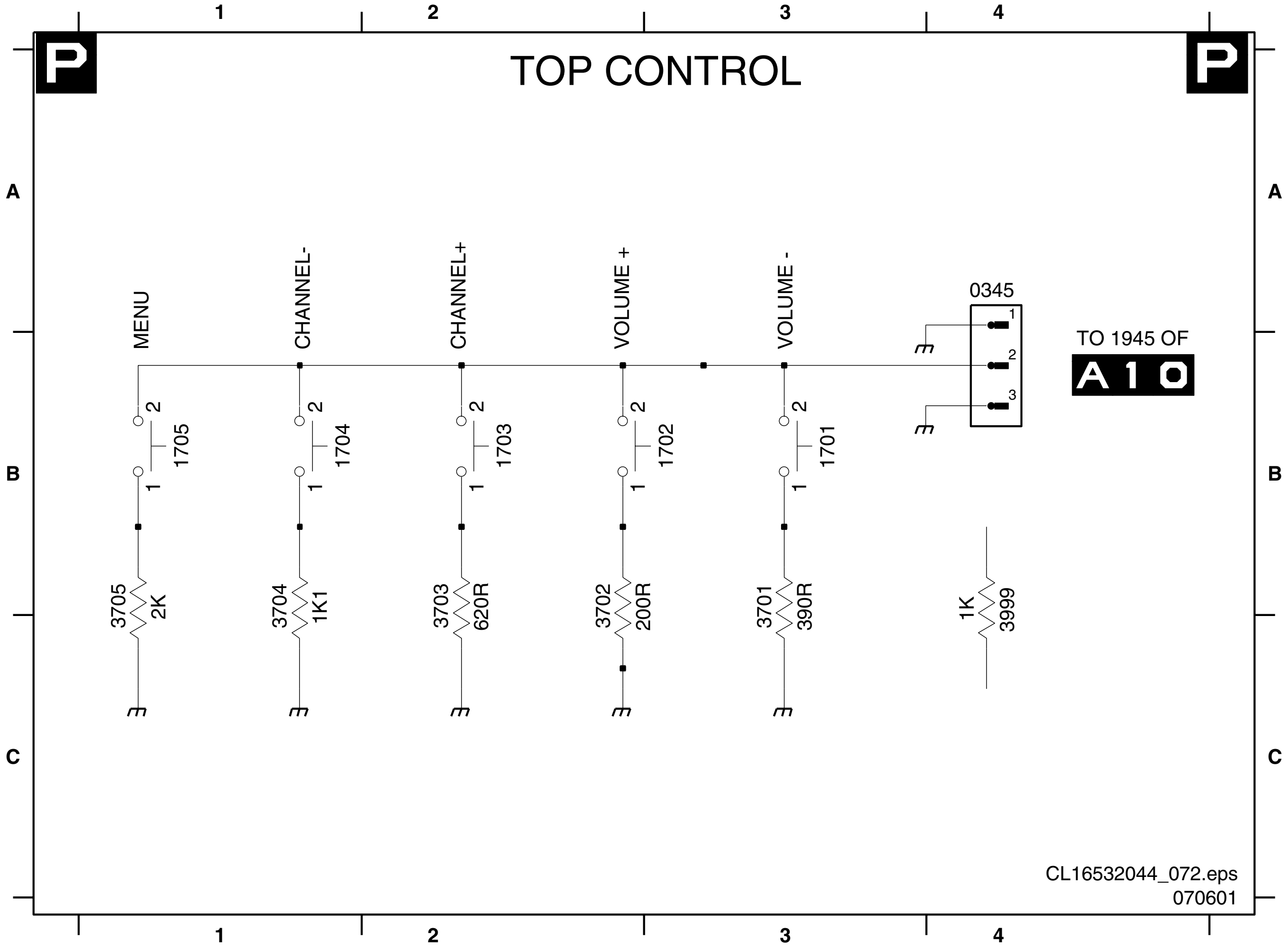


CL16532044_089.eps
070601

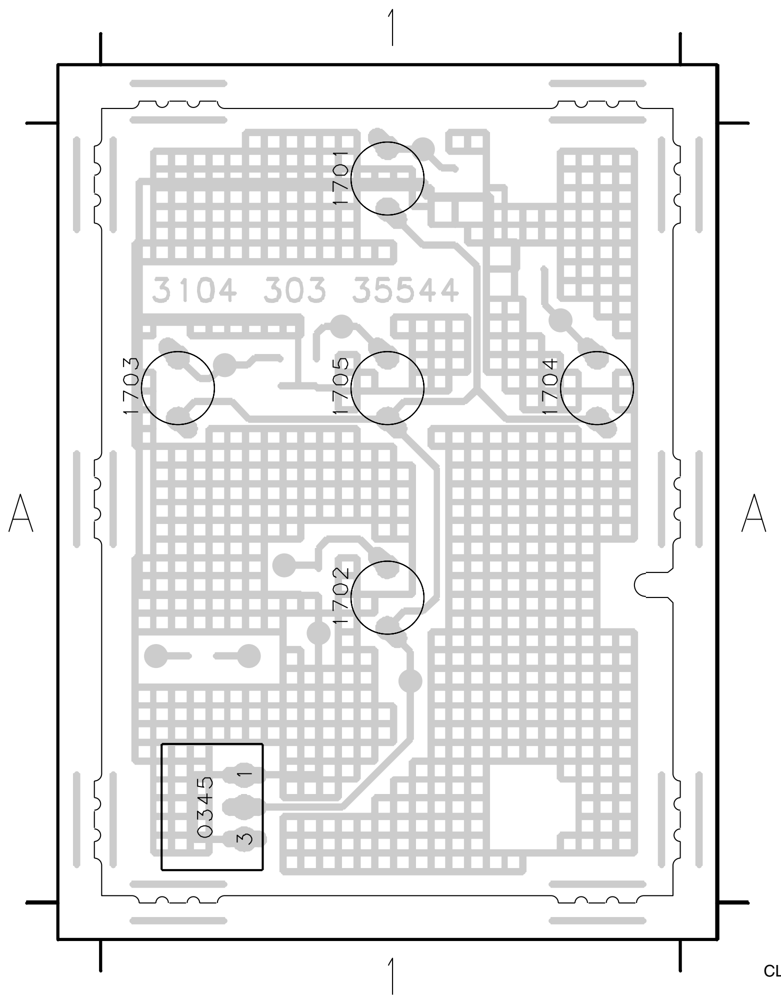
| | | | |
|---|---|---|---|
| 1326 | B1 | 3849 | C1 |
| 1327 | A1 | 3999 | A1 |
| 1328 | C1 | 4800 | B1 |
| 1333 | A1 | 4801 | B1 |
| 1344 | A1 | 4802 | A1 |
| 1346 | A1 | 4803 | A1 |
| 1936 | A1 | 4804 | B1 |
| 2811 | B1 | 5800 | A1 |
| 2813 | A1 | 6801 | C1 |
| 3802 | C1 | 6802 | C1 |
| 3803 | B1 | 6803 | B1 |
| 3804 | B1 | 6804 | C1 |
| 2803 | B1 | 6805 | B1 |
| 2804 | B1 | 6806 | B1 |
| 2805 | B1 | 6807 | C1 |
| 2806 | B1 | 6808 | C1 |
| 2807 | C1 | 7811 | C1 |
| 2810 | C1 | 7812 | B1 |
| 2834 | A1 | 7813 | C1 |
| 2840 | A1 | 9800 | B1 |
| 2841 | A1 | 9802 | A1 |
| 3801 | C1 | 9803 | A1 |
| 3805 | B1 | 9810 | A1 |
| 3806 | B1 | | |
| 3808 | C1 | | |
| 3809 | C1 | | |
| 3810 | C1 | | |
| 3811 | B1 | | |
| 3812 | C1 | | |
| 3813 | B1 | | |
| 3814 | B1 | | |
| 3815 | C1 | | |
| 3816 | C1 | | |
| 3826 | A1 | | |
| 3827 | A1 | | |
| 3828 | A1 | | |
| 3829 | A1 | | |
| 3830 | A1 | | |
| 3835 | A1 | | |
| 3842 | A1 | | |
| 3845 | C1 | | |
| 3846 | C1 | | |
| 3847 | C1 | | |
| 3848 | C1 | | |

## Top Control Panel

| 0345 A4 | 1702 B3 | 1704 B1 | 3701 B3 | 3703 B2 | 3705 B1 |
|---|---|---|---|---|---|
| 1701 B3 | 1703 B2 | 1705 B1 | 3702 B2 | 3704 B1 | 3999 B4 |

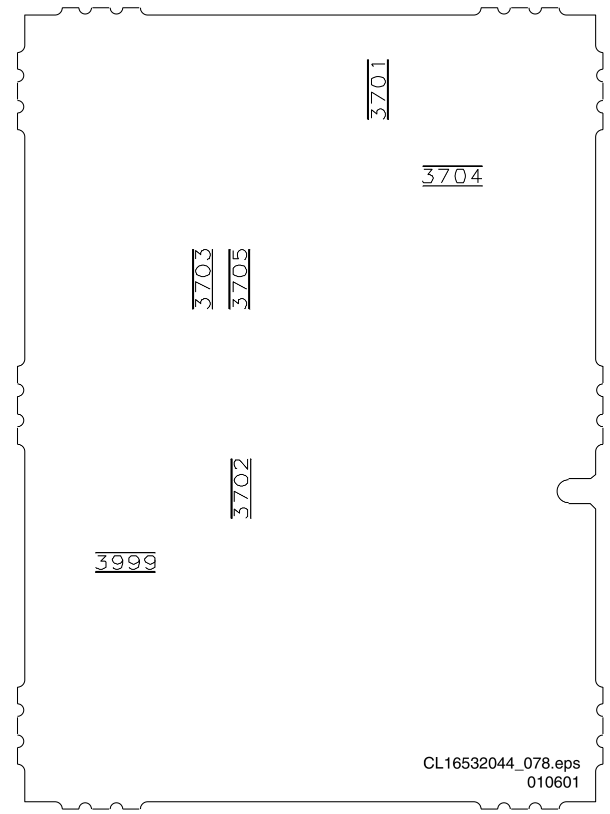



## Layout Top Control Panel (Top Side)




| | |
|---|---|
| 0345 | A1 |
| 1701 | A1 |
| 1702 | A1 |
| 1703 | A1 |
| 1704 | A1 |
| 1705 | A1 |
| 3701 | A1 |
| 3702 | A1 |
| 3703 | A1 |
| 3704 | A1 |
| 3705 | A1 |
| 3999 | A1 |

## Layout Top Control Panel (Bottom Side)



Colour Television | Chassis

# EM3E

AA 02.01

Service
Service
Service

# Service Information

(GB) **CHANGES IN COURSE OF PRODUCTION**

**INTRODUCTION OF NEW L.O.T.**
During production (from AG02 onwards), a new Line Output Transformer (from Eldor) is introduced. Together with this change, the LSP is changed to version 4, and some components on LSP and PTP panel are changed (see table).
The new L.O.T. is pin-compatible with the current one.

Involved sets:
- 28PW8807.
- 32PW8807.
- 32PW9556.
- 32PW9566.
- 32PW9576.

| EM3E | Philips L.O.T. (3128 138 21531) | Eldor L.O.T. 1392.9002D (2422 531 02532) |
|---|---|---|
| 28PWxxxx | 3403: not present (1)<br>**3404: 1R** (2) | 3403 : 3R3 (4822 052 11338).<br>**3404 : 3R3 (4822 052 11338).** |
| 32PWxxxx | 2420: 1n0 (1)<br>3403: not present (1)<br>**3404: 1R** (2) | 2420: 1n2 (4822 121 70595).<br>3403: 3R3 (4822 052 11338).<br>**3404: 3R3 (4822 052 11338).** |
| | | In the NVM, EHT compensation has been set to 12 iso 9. |

1. In regular font: Changes on LSP (Large Signal Panel)
2. In **bold** font: Changes on PTP (Picture Tube Panel).

**Note:**
- On the Eldor L.O.T., the 2 focus wires are inverted. A yellow dot on top of the L.O.T. marks the place where the red wire has to be inserted.
- Also, the potmeters for static and dynamic focus have switched place and the turn direction is contrary to the one on the Philips L.O.T.

(D) **ÄNDERUNGEN BEI DER PRODUKTION**

**EINFÜHRUNG DES NEUEN L.O.T.**
Während der Produktion (ab AG02) wird ein neuer Zeilenablenkungstransformer (engl. Line Output Transformer) von Eldor eingeführt. Zusammen mit dieser Änderung wird das Großsignal-Panel auf Version 4 aktualisiert, und einige Bauteile auf dem Großsignal-Panel und dem Bildröhren-Panel werden geändert (siehe Tabelle).
Der neue L.O.T. ist Pin-kompatibel zu dem derzeitigen.
Betroffene Geräte:
- 28PW8807.
- 32PW8807.
- 32PW9556.
- 32PW9566.
- 32PW9576.

| EM3E | Philips L.O.T. (3128 138 21531) | Eldor L.O.T. 1392.9002D (2422 531 02532) |
|---|---|---|
| 28PWxxxx | 3403: not present (1)<br>**3404: 1R** (2) | 3403 : 3R3 (4822 052 11338).<br>**3404 : 3R3 (4822 052 11338).** |
| 32PWxxxx | 2420: 1n0 (1)<br>3403: not present (1)<br>**3404: 1R** (2) | 2420: 1n2 (4822 121 70595).<br>3403: 3R3 (4822 052 11338).<br>**3404: 3R3 (4822 052 11338).** |
| | | Im nicht-flüchtigen Speicher wurde die Höchstspannungskompensation auf 12 iso 9 eingestellt. |

1. In normaler Schrift: Änderungen am Großsignal-Panel.
2. In **Fettschrift:** Änderungen am Bildröhren-Panel.

**Hinweis:**
- Beim Eldor L.O.T. sind die beiden Fokusdrähte vertauscht. Ein gelber Punkt auf dem L.O.T. markiert die Stelle, an der das rote Kabel eingesteckt werden muss.
- Außerdem haben die Potentiometer für den statischen und den dynamischen Fokus die Plätze getauscht, und die Drehrichtung ist entgegengesetzt zu der beim Philips-L.O.T



Published by JA 0262 Service PaCE    Printed in the Netherlands    Subject to modification    3122 785 40600

PHILIPS

## (F) MODIFICATIONS EN COURS DE PRODUCTION

**INTRODUCTION D'UN NOUVEAU TRANSFORMATEUR LOT.**
Un nouveau transformateur de sortie de ligne (Eldor) a été introduit au cours de la production (à partir d'AG02). Cette modification s'accompagne d'un changement de version (version 4) pour la platine forts signaux (LSP), et certains composants de la platine forts signaux (LSP) et de la platine tube-image (PTP) ont été modifiés (voir tableau).
Le brochage du nouveau transformateur LOT est compatible avec l'existant.

Postes concernés :
- 28PW8807.
- 32PW8807.
- 32PW9556.
- 32PW9566.
- 32PW9576.

| EM3E | Philips L.O.T. (3128 138 21531) | Eldor L.O.T. 1392.9002D (2422 531 02532) |
|---|---|---|
| 28PWxxxx | 3403: not present (1)<br>**3404: 1R** (2) | 3403 : 3R3 (4822 052 11338).<br>**3404 : 3R3 (4822 052 11338).** |
| 32PWxxxx | 2420: 1n0 (1)<br>3403: not present (1)<br>**3404: 1R** (2) | 2420: 1n2 (4822 121 70595).<br>3403: 3R3 (4822 052 11338).<br>**3404: 3R3 (4822 052 11338).** |
| | | Dans la NVM, la compensation THT a été réglée à 12 au lieu de 9. |

1. En caractères normaux : modifications apportées à la platine forts signaux (LSP)
2. En caractères **gras**: modifications apportées à la platine tube-image (PTP).

**Note :**
- Sur le transformateur LOT Eldor, les deux fils de la commande de mise au point ont été inversés. Un point jaune sur le LOT marque l'endroit où le fil rouge doit être placé.
- En outre, les potentiomètres de mise au point statique et dynamique ont changé de place, et leur sens de rotation est contraire à celui du transformateur LOT Philips.

## (E) CAMBIOS DURANTE LA PRODUCCIÓN

**INTRODUCCIÓN DEL NUEVO L.O.T.**
Durante la producción (desde AG02 en adelante), se ha introducido un nuevo transformador de salida de línea (de Eldor). Conjuntamente con este cambio, se ha cambiado el LSP a la versión 4 y algunos componentes de los paneles LSP y PTP han cambiado (véase la tabla).
El nuevo L.O.T. es compatible con el actual a nivel de patillas.

Equipos involucrados:
- 28PW8807.
- 32PW8807.
- 32PW9556.
- 32PW9566.
- 32PW9576.

| EM3E | Philips L.O.T. (3128 138 21531) | Eldor L.O.T. 1392.9002D (2422 531 02532) |
|---|---|---|
| 28PWxxxx | 3403: not present (1)<br>**3404: 1R** (2) | 3403 : 3R3 (4822 052 11338).<br>**3404 : 3R3 (4822 052 11338).** |
| 32PWxxxx | 2420: 1n0 (1)<br>3403: not present (1)<br>**3404: 1R** (2) | 2420: 1n2 (4822 121 70595).<br>3403: 3R3 (4822 052 11338).<br>**3404: 3R3 (4822 052 11338).** |
| | | En la NVM, la compensación EHT se ha fijado en 12 en vez de 9. |

1. Con letra normal: cambios del LSP (panel de señales fuertes)
2. Con letra **negrita**: cambios del PTP (panel del tubo de imagen).

**Nota:**
- En el L.O.T. de Eldor, se han invertido los 2 hilos del foco. Un punto amarillo en la parte superior del L.O.T. marca el lugar donde debe introducirse el hilo rojo.
- Además, los potenciómetros del foco estático y dinámico han cambiado de lugar y la dirección de giro es inversa a la del L.O.T. de Philips

## (I) MODIFICHE IN CORSO DI PRODUZIONE

**INTRODUZIONE DEL NUOVO TRASFORMATORE DI USCITA DI LINEA (L.O.T.)**

Durante la produzione è stato introdotto (da AG02 in poi), un nuovo trasformatore di uscita di linea (della Eldor). Assieme a questa modifica, l'LSP è stato modificato alla versione 4 ed alcuni componenti sull'LSP e sul pannello PTP sono stati cambiati (fare riferimento alla tabella).
Il nuovo L.O.T. è compatibile con i piedini di quello attuale.

Apparecchi interessati:
- 28PW8807.
- 32PW8807.
- 32PW9556.
- 32PW9566.
- 32PW9576.

| EM3E | Philips L.O.T.<br>(3128 138 21531) | Eldor L.O.T. 1392.9002D<br>(2422 531 02532) |
|---|---|---|
| 28PWxxxx | 3403: not present (1)<br>**3404: 1R** (2) | 3403 : 3R3 (4822 052 11338).<br>**3404 : 3R3 (4822 052 11338).** |
| 32PWxxxx | 2420: 1n0 (1)<br>3403: not present (1)<br>**3404: 1R** (2) | 2420: 1n2 (4822 121 70595).<br>3403: 3R3 (4822 052 11338).<br>**3404: 3R3 (4822 052 11338).** |
| | | In NVM, la compensazione EHT è stata impostata su 12 iso 9. |

1. In caratteri regolari: modifiche sull'LSP (Large Signal Panel, pannello a segnale largo)
2. In **grassetto**: modifiche sul PTP (Picture Tube Pane, pannello del cinescopio).

**Nota**
- Sull'LOT Eldor i due fili del fuoco sono invertiti. Un punto giallo sopra il trasformatore di uscita di linea, contrassegna il punto in cui inserire il filo rosso.
- Inoltre, i potenziometri per il fuoco statico e quello dinamico sono stati collocati in posizioni diverse e la direzione di giro è all'opposto rispetto a quella dell' LOT della Philips.